Origins of Sockeye Salmon in the Kodiak Management Area

North Shelikof Strait Fishery, 6 July through 25 July, 1990

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ACKNOWLEDGEMENTS

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INTRODUCTION

The Kodiak Salmon Management Area (KMA) encompasses all inland and state marine waters on the south side of the Alaska Peninsula from Kilokak Rocks to Cape Douglas and the Kodiak Archipelago (Figure 1). The area is managed for local salmon stocks excluding: 1) the Cape Igvak Section of the Mainland District which is regulated from 9 June through 25 July for Chignik origin sockeye salmon; and 2) North Shelikof Strait which is managed from 6 July through 25 July for Cook Inlet sockeye salmon, secondary to local stocks. The purpose of this report is to estimate the stock composition of the North Shelikof Strait sockeye catch for the 6 July through 25 July management period. North Shelikof Strait includes the seaward and shoreward zones of the Dakavak Bay, Outer Kukak Bay, Hallo Bay, and Big River Sections of the Mainland District and the Southwest and Northwest Afognak and Shuyak Island Sections of the Afognak District (Figure 1).

In March 1990, the State Board of Fisheries established a management plan for the North Shelikof Strait that restricts interception of sockeye salmon annually from 6 July through 25 July. The plan recognizes that an incidental (non local) sockeye harvest occurs in North Shelikof Strait while managing for local Kodiak stocks. The plan limits non-traditional harvest of Upper Cook Inlet sockeye salmon from occurring by seasonally closing: 1) the Southwest Afognak Section seaward zone when a 50,000 sockeye catch has been reached (seaward and shoreward zones combined); and 2) the Mainland District, NW Afognak Section, and Shuyak Island seaward zones when the combined seaward and shoreward zone catch reaches 15,000 sockeye salmon.

Figure 1. Map of the Kodiak Management Area.

In 1988 the North Shelikof Strait sockeye catch was 453,336 fish for the 6 July through 25 July period (Malloy 1988). During 1989, there was no catch because of an area wide closure caused by the M/V Exxon Valdez oil spill. In 1990, the first year of plan implementation, 80,658 sockeye salmon were caught with the distribution: 29% Southwest Afognak Section (22,944 fish); 6% Northwest Afognak and Shuyak Island Sections combined (5,157 fish); and 65% Mainland District (52,557 fish) (Table 1 and Figure 2).

Three general openings occurred during the 1990 fishery: 1) a 57 hour fishery from 6 July to 8 July; 2) an 81 hour restricted fishery from 13 July to 16 July; and 3) an 81 hour restricted fishery from 20 July to 23 July. The second opening the restriction was 24 hours less fishing time in the Mainland District and seaward zones of the Northwest Afognak and Shuyak Island Sections, while the third period restriction was 24 hours less fishing time in the Mainland District and closure of all seaward zones except for the Southwest Afognak Section. The three openings accounted for 18%, 46%, and 36% of the total area catch, respectively. Although 80,658 sockeye salmon were caught in the North Shelikof Strait during the 1990 fishery, the catch which occurred during concurrent seaward and shoreward zone openings was 59,641 fish, which is 8% below the 65,000 fish restriction. While the catch restriction was not reached, the 15,000 fish sub area restriction for the Mainland District, and Shuyak Island and Northwest Afognak Sections combined was exceeded by 21,697 fish. This excess was offset by the Southwest Afognak Section catch, which was 27,056 fish less than the 50,000 fish restriction for that sub-area.

Sockeye stock composition data for the North Shelikof Strait are limited. Tagging conducted in 1948, 1949, 1977, and 1981 indicate that the June

Table 1.   Number of permits and landings, and salmon catch numbers and weights by species in North Shelikof Strait during the 6 July through 25 July management period, by district and section, 1990.

Area	Date	Permits	Lndgs	Chinook #	Chinook lbs.	Sockeye #	Sockeye lbs.	Coho #	Coho lbs.	Pink #	Pink lbs.	Chum #	Chum lbs.	Total #	Total lbs.
Afognak District															
Southwest Afognak Section															
	7/06-7/08 TOTAL	35	45	82	1,124	10,742	57,861	1,028	7,074	16,244	49,518	2,667	20,938	30,763	136,515
	AVG.WT.				13.7		5.4		6.9		3.1		7.9		
	7/13-7/16 TOTAL	26	44	88	886	4,187	20,887	557	3,891	10,083	30,763	1,605	13,093	16,520	69,520
	AVG.WT.				10.1		5.0		7.0		3.1		8.2		
	7/20-7/23 TOTAL	29	53	107	1,648	8,015	46,927	2,020	13,804	27,425	81,540	1,764	12,947	39,331	156,866
	AVG.WT.				15.4		5.9		6.8		3.0		7.3		
	Grand Total	64	142	277	3,658	22,944	125,675	3,605	24,769	53,752	161,821	6,036	46,978	86,614	362,901
	AVG.WT.				13.2		5.5		6.9		3.0		7.8		
Northwest Afognak Section															
	7/06-7/08 TOTAL	9	11	5	33	3,079	12,221	5	31	511	1,615	81	729	3,681	14,629
	AVG.WT.				6.6		4.0		6.2		3.2		9.0		
	7/13-7/16 TOTAL	7	7	4	24	312	1,866	27	194	433	1,238	69	563	845	3,885
	AVG.WT.				6.0		6.0		7.2		2.9		8.2		
	7/20-7/23 TOTAL	5	5	1	27	1,766	9,300	15	90	1,209	3,669	88	619	3,079	13,705
	AVG.WT.				27.0		5.3		6.0		3.0		7.0		
	Grand Total	19	23	10	84	5,157	23,387	47	315	2,153	6,522	238	1,911	7,605	32,219
	AVG.WT.				8.4		4.5		6.7		3.0		8.0		
ALL AFOGNAK															
	7/06-7/08 TOTAL	44	56	87	1,157	13,821	70,082	1,033	7,105	16,755	51,133	2,748	21,667	34,444	151,144
	AVG.WT.				13.3		5.1		6.9		3.1		7.9		4.4
	7/13-7/16 TOTAL	33	51	92	910	4,499	22,753	584	4,085	10,516	32,001	1,674	13,656	17,365	73,405
	AVG.WT.				9.9		5.1		7.0		3.0		8.2		4.2
	7/20-7/23 TOTAL	34	58	108	1,675	9,781	56,227	2,035	13,894	28,634	85,209	1,852	13,566	42,410	170,571
	AVG.WT.				15.5		5.7		6.8		3.0		7.3		4.0
	Grand Total	111	165	287	3,765	28,101	149,072	3,652	25,098	55,905	168,349	6,274	48,905	94,219	395,129
	AVG.WT.				13.1		5.3		6.9		3.0		7.8		4.2

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Table 1.   (page 2 of 3)

Area	Date		Permits	Lndgs	Chinook #	Chinook lbs.	Sockeye #	Sockeye lbs.	Coho #	Coho lbs.	Pink #	Pink lbs.	Chum #	Chum lbs.	Total #	Total lbs.
Mainland District																
Big River Section																
	7/06-7/08	TOTAL	0	0												
		TOTAL	6	9	1	2	5,154	33,808	103	996	406	1,202	1,973	15,970	7,637	51,978
	7/13-7/16	AVG.WT.				2.0		6.6		9.7		3.0		8.1		
		TOTAL			0	0	59	293	0	0	205	640	158	1,325	422	2,258
	7/20-7/23	AVG.WT.				0.0		5.0		0.0		3.1		8.4		5.4
	Grand Total		6	10	1	2	5,213	34,101	103	996	611	1,842	2,131	17,295	8,059	54,236
		AVG.WT.				2.0		6.5		9.7		3.0		8.1		6.7
Hallo Bay Section																
	7/06-7/08		0	0												
	7/13-7/16		0	0												
	7/20-7/23		3	4	0	0	473	2,788	16	102	1,235	3,683	1,220	10,072	2,944	16,645
		AVG.WT.						5.9		6.4		3.0		8.3		5.7
	Grand Total		3	4	0	0	473	2,788	16	102	1,235	3,683	1,220	10,072	2,944	16,645
		AVG.WT.						5.9		6.4		3.0		8.3		5.7
Outer Kukak Bay Section																
	7/06-7/08		0	0												
	7/13-7/16		3	3	3	34	533	3,312	5	48	163	479	116	1,059	820	4,932
		AVG.WT.				11.3		6.2		9.6		2.9		9.1		6.0
	7/20-7/23		0	0												
		AVG.WT.														
	Grand Total		3	3	3	34	533	3,312	5	48	163	479	116	1,059	820	4,932
		AVG.WT.				11.3		6.2		9.6		2.9		9.1		6.0

Table 1.   (page 3 of 3)

Area	Date	Permits	Lndgs	Chinook #	Chinook lbs.	Sockeye #	Sockeye lbs.	Coho #	Coho lbs.	Pink #	Pink lbs.	Chum #	Chum lbs.	Total #	Total lbs.
Dakavak Bay Section															
	7/06-7/08 TOTAL	7	7	8	74	1,046	5,213	1	15	175	530	1,088	10,246	2,318	16,078
	AVG.WT.				9.3		5.0		15.0		3.0		9.4		6.9
	7/13-7/16 TOTAL	55	56	68	895	26,732	173,172	915	6,255	4,013	12,821	10,286	85,915	42,125	279,058
	AVG.WT.				13.0		6.5		7.1		3.2		8.3		6.6
	7/20-7/23 TOTAL	32	32	49	550	18,560	110,633	2,824	19,356	10,298	33,458	4,379	34,623	36,110	198,620
	AVG.WT.				11.2		6.0		6.9		3.2		8.0		5.5
Grand Total		55	95	125	1,519	46,338	289,018	3,740	25,626	14,486	46,809	15,753	130,784	80,553	493,756
	AVG.WT.				12.2		6.2		6.9		3.2		8.3		6.1
ALL MAINLAND		58	111	129	1,555	52,557	328,472	3,864	26,772	16,454	52,683	19,174	158,795	92,178	568,277
	AVG.WT.				12.1		6.3		6.9		3.2		8.3		6.2

NW Afognak

6.4%
(5,157)

SW Afognak

65.2%
(52,557)

28.4%
(22,944)

Mainland
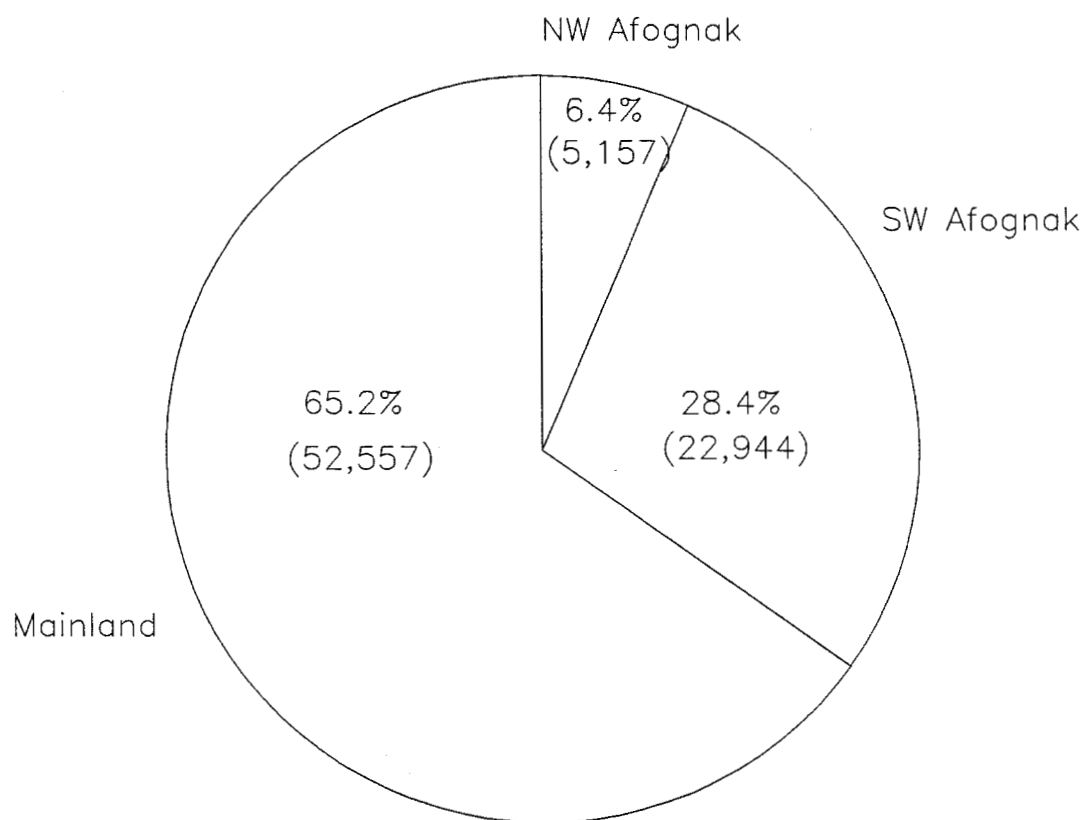
Figure 2. Distribution of the North Shelikof Strait sockeye
salmon catch for the 6 July to 25 July management
period, in percent and numbers of fish, by area,
1990.

composition ranges from 30% to 100% local Kodiak fish and 0% to 59% Cook Inlet fish (Barrett 1989a). The only information available for July is for the 1988 catch. Barrett (1989a) using catch timing, age, and length data estimated that the catch was approximately 95% Upper Cook Inlet and 5% local fish. In our report, stock composition of the 1990 July catch will be determined from analyzing timing, mean whole fish weight, age specific length, age class, and scale pattern data.

METHODS

Catch Timing

The timing of the North Shelikof Strait catch during the 6 July to 25 July management period was compared to timing of various local and non local sockeye stocks potentially contributing to the fishery. The Kodiak stocks examined were those of Red River, Karluk, Uganik, Litnik, and Olga Bay. Non-local stocks were Upper Cook Inlet and Chignik Lake. The stock timing data expressed by daily terminal catch, escapement, and run numbers were hindcast in time to account for potential travel time from the North Shelikof Strait. The adjustments used were:

Kodiak Stocks:

    Litnik Escapement: 5 days prior
    Uganik Escapement: 5 days prior
    Karluk Escapement: 10 days prior
    Red River Escapement: 8 days prior
    Red River Catch: Catch: 6 days prior
    SW Kodiak District Catch (Red River stock): 6 days prior
    Alitak Catch (Olga Bay Stocks): 7 days prior

Non-Local Stocks:

    Cook Inlet Central District Catch: 6 days prior
    Chignik River Run: 10 days prior

Average Weight

Average whole fish weights from the North Shelikof Strait catch were compared to the average whole fish weights of terminal catches by purse seine at Red River, Alitak Bay District, and Chignik Lagoon, and by drift gill net in the Upper Cook Inlet Central District. Average whole fish weights were computed from fish ticket data adjusted in time to the 6 July through 25 July North Shelikof Strait management period. The fish ticket data provided catch location and date, gear type, and total number of fish and weight to the nearest pound by species.

Catch and Escapement Sampling for Age and Length

Strategy for the KMA catch and escapement sampling program is based on quantifying temporal changes in age composition of the commercial catch and specific major system escapements. Escapement (240) and catch (600) sample sizes were derived employing the multinomial proportion approach of Thompson (1987). A sample size of 240 fish per week for major systems provides for simultaneously estimating percent contribution of each major age class within 7% of the true percentage, 90% of the time. A commercial catch sample of 600 fish per district fishery opening allows for stating the true age contribution within 5%, 90% of the time. Both sample sizes take into consideration regenerated and nonageable scales.

Methods used for scale sampling were adaptations of those described by Clutter and Whitesel (1956) and Koo (1962). The preferred scale for age and racial investigations as defined by Clutter and Whitesel (1956) is a scale on a fish's left side, two scale rows above the lateral line on an approximate diagonal drawn

from the posterior end of the dorsal fin to the anterior end of the anal fin. Individual scales were cleaned and mounted on sequentially numbered, gummed scale cards (usually 40 scales to a card). Permanent scale impressions were made in cellulose acetate (Clutter and Whitesel 1956).

During the North Shelikof Strait fishery, sockeye catch was sampled for age by taking a preferred scale from approximately 600 fish from the Mainland District Dakavak Section on 14 July and 23 July, and similarly from the Southwest Afognak Section on 16 July and 20 July. Sampling occurred onboard purse seine vessels encountered on the fishing grounds. For the minor system escapements (Malina, Kaflia, and Litnik stocks) a single 600 fish sample was collected at or near peak abundance. The Malina and Kaflia samples were obtained using a beach seine, while the Litnik sample was collected at a weir. Length measurements (mid-eye to fork-of-tail) for catch and escapement samples were recorded to the nearest 1 mm, and obtained from each fish sampled using a 1mm graduated caliper.

A more detailed description of catch and escapement sampling procedures for the KMA can be found in Holmes and Monkiewicz (1988), Chignik Management Area in Barrett (1989b), and for the Lower Cook Inlet area in Waltemyer (1989).

Age Designation

Ageing of scales was performed with a microfiche reader and 84X lens. Age designation was accomplished following criteria described in Koo (1962) and Moser (1969). Freshwater annuli were identified by a narrowing of the relative distance between at least two consecutive circuli which were preceded by at least three circuli (beginning at the scale focus). Criteria for the second freshwater

zone were the same as the first, except the last circulus of the first freshwater zone was the starting point. Marine zones were defined as regions where a minimum of three consecutive circuli were more narrowly spaced than the three preceding circuli. All ages are reported in European notation with the integer left of the decimal point freshwater age and to the right, marine age. Total age of a particular fish is the sum of the freshwater and marine ages plus one (accounting for the egg to emergent fry time frame).

Scale Pattern Analysis

Standard and Unknown Sample Size

Escapement and fishery samples will be referred to as standard and unknown samples respectively, following the convention of Myers et al. (1987). Cook (1982) determined that precision of stock composition estimates behave asymptotically as standard and unknown sample sizes are increased. A standard or unknown file was constructed when a particular stock or fishery sample had at least 50 scales per age class available for measurement. The maximum number of scales measured for standard and unknown samples was 210. For Cook Inlet, age 1.3 and 2.3 standards from Central District commercial drift gill net catch samples were used. Two time strata were designated as having the greatest probability of being present in the North Shelikof Strait during the time of concern (6-25 July). The first standard was for the period 20 July through 25 July (COOK1), and the second 27 July through 30 July (COOK2), for both age classes. Standard construction for KMA stocks was comprised of only those portions of a particular escapement which potentially could be present in the North Shelikof commercial fishing areas and had a 1.3 or 2.3 age contribution

greater than 5.0% (Appendix A). Standards were constructed for the Frazer (2.3), Karluk (2.3), Red River (1.3 and 2.3), Malina (2.3), and Upper Station (1.3) sockeye stocks. For the Chignik Management Area, commercial purse seine catch samples collected after 5 August were used to construct an age 2.3 standard. The 1.3 age class, although contributing greater than 5% to the escapement, was not included due to lack of scale samples.

Procedures Used for Scale Measurement

Scale measurement data were collected using the Biosonics optical pattern recognition system (OPRS). The system consists of a compound microscope, ocular lens, frame grabber, digitizing tablet, and microcomputer used for collection and storage of scale measurement data. The procedure for scale data collection consisted of: 1) establishing a reference line (parallel to a scales reticulated region) which was employed for all subsequent scale measurements for that stock or unknown sample; 2) identifying the center of the scale focus (starting point); 3) measuring incremental distances from the focus to the last circuli within the first or second freshwater zone; 4) saving collected data to a specified raw data file. Two measurement axes, 73 and 90 degree lines perpendicular to the reference line were used to collect data for age 1.3 and 2.3 scales, respectively (Clutter and Whitsel 1956; Koo 1962; Narver 1963). All data were collected at 200x magnification. Scales with poor acetate impressions and those sampled from a region other then the preferred area were not measured.

Once counts and measurements were obtained in a raw form, the data base was used for variable construction. A Basic reformatting program, Reform1 (written by Larry Greer, ADF&G, Kodiak, AK) was used to construct variables which described

the freshwater growth phases of the sockeye scales. Variables derived were circuli counts (CC) and incremental circuli distances (ID) beginning at the scale focus and ending at the last circulus in either the first or second freshwater zone. The maximum number of variables available for model development was limited by the fewest number of circuli counted for an individual scale. For example, if a stock had one scale with only five circuli, then the maximum number of potential variables for that stock would be six (five incremental distances and one circuli count).

Discriminant Model Selection and Development

The objective of stock separation analysis is to develop a model or set of models which delineate stocks in mixed stock samples with a high degree of accuracy. The linear discriminant function (LDF) proposed by Fisher (1936) has been widely employed in sockeye salmon stock separation studies (Conrad 1984 and others). The quadratic discriminant function (QDF) suggested by Smith (1947) has also been used (Anas and Murai 1969, Bilton and Messinger 1975). For the present investigation both LDF and QDF models were evaluated for their performance in identifying known stocks in unknown samples. The assumptions of the LDF are: 1) variables are multivariate normal; 2) variance-covariance matrices between groups are equal; 3) all possible groups or stocks are represented. The QDF has assumptions (1) and (3) from above. Testing the assumptions was accomplished by screening all variables individually for univariate normality using frequency histograms and evaluating equality of the variance-covariance structure using a procedure described by Box (1949). Selection of variables was accomplished using a forward stepping F-ratio procedure. An F-to-enter value was set at 4.0

with an F-to remove value set at 3.9. As suggested by Davis (1987) models were developed which included all possible variables (Full Model).

Accuracy in correctly classifying individuals to stock or group of origin was determined following Cook's (1982) proposed use of the "leaving one out" method of Lachenbrunch (1967). Corrected stock proportional estimates and standard errors, incorporating misclassification error rates were derived by methods provided by Pella and Robertson (1979) and Cook and Lord (1978). These corrections were made using a Fortran program adapted for microcomputer use by Scott McPhearson (ADF&G, Douglas, AK).

Age 1.3 Models. Initially, a four-stock model was created using the standards Red River (RR), Cook Inlet1 (COOK1), Cook Inlet2 (COOK2), and Upper Station (late run) stocks. The Upper Station stock had the fewest fresh water circuli (5, mean=9), Cook Inlet intermediate circuli numbers (mean=10), and Red River the highest circuli counts (mean=15). With the fewest number of circuli being five, only six variables could be considered for inclusion in any age 1.3 model. The variables were circuli count (V1), and incrimental distances 1 though 5 (V2 through V6). All variables constructed did not deviate appreciably from univariate normality. Variables selected for initial models via the stepwise process were V2 - V6, with V6, V3, and V5 having the largest F-ratios.

The initial age 1.3 four stock model provided poor classification accuracy (56.2%) with large misclassification error between COOK1 and COOK2. Subsequently, these two stocks were tested using Hotelling's T^2 test statistic and found to be significantly different (P<.094), which required use of the

COOK1 standard for the first commercial catch period (7/14-7/17) and COOK2 for the second catch period (7/21-7/23). A three-stock model (COOK1-RR-Upper Station) was formulated (mean classification accuracy=69.9%) but discarded because the Upper Station stock largely misclassified as COOK1.

Final Model building considered only the Cook Inlet and Red River stocks. Model development consisted of testing the hypothesis of equal group dispersion (i.e equality of between group variance-covariance matricies), with both models (COOK1-RR and COOK2-RR) providing significant test statistics (P<.001 and P<.009, respectively). Mean classification accuracy for the QDF variable selected models (RR-COOK1 and RR-COOK2) were 73.8% and 77.2%, respectively (Table 2). Misclassification errors with full models (all variables included) were slightly reduced providing for increased balance in misclassification between stocks.

Age 2.3 Models. An initial age 2.3 seven-stock model was created including Cook Inlet 1&2 (COOK1 and COOK2), Red River (RR), Chignik (CHK), Karluk (KK), Frazer (FRZ), and Malina (MAL). Mean circuli counts for each stock were COOK1 and COOK2 (16), RR (23), CHK (16), KK (18), FRZ (20), and MAL (14). The least number of circuli for any one stock was 11 (MAL stock), therefore a suite of 12 variables were possible for constructing models (circuli count-V1 and 11 incrimental distances V2-V12). All but one variable (V9) under consideration did not deviate appreciably from univariate normality, therefore 11 variables were used for model building. Stepwise variable selection for the seven stock model choose variables V1-V3, V6-V8, and V10-V12 for discriminant analyses. The model had poor classification accuracy (mean=59.1%) with large misclassification error between COOK1-COOK2 and also RR-KK. Hotelling's T^2 statistics for testing the hypothesis

Table 2. Classification accuracy, model type, and variables included for classifying 1990 North Shelikof Strait age 1.3 sockeye salmon commercial catch samples.

Model Number	N	Actual Stock Of Origin	Classified Stock Of Origin		
			COOK1	COOK2	RED RIVER
1	203	COOK1	162 (79.8%)	----	41 (20.2%)
		COOK2	----	----	----
	201	RED RIVER	54 (26.9%)	----	147 (73.1%)
				$\overline{X}_{cc}^{a}$= 76.5% (QDF with variables V1-V6)	
2	203	COOK1		----	----
	201	COOK2		164 (80.8%)	39 (19.2%)
		RED RIVER		41 (20.4%)	160 (79.6%)
				$\overline{X}_{cc}^{a}$= 80.2% (QDF with variables V1-V6)	

[a]Mean classification accuracy.

of equality of group means comparing COOK1-COOK2 and also RR-KK resulted in non-significant (P=.479), and significant statistics (P<=.001), respectively.

Further analyses were conducted using a five-stock model which included COOK1, CHK, FRZ, MAL, and RR stocks. Equality of group dispersion was tested and a significant statistic derived (P<.001). Final age 2.3 model development was conducted using the quadratic discriminant function. Final models used for classification of unknown fishery catch samples are presented in Table 3.

RESULTS

Timing

To determine potential stocks present in the North Shelikof Strait during the fishery, timing data for various local and non-local stocks were plotted (Figures 3-6). Based on escapement timing, the Litnik and Uganik runs (local stocks) were essentially finished when the North Shelikof Strait fishery began, while the Karluk system was between runs (Figures 3 and 4). Specifically, the first run to Karluk was over when the Shelikof fishery began, and the fishery was completed when the second run was just beginning. Conversely, the Red River run, which produced a 1,477,083 fish terminal catch and a 371,282 fish escapement, over-lapped the North Shelikof fishery (Figure 6). The Alitak Bay District stocks collectively, as measured by terminal purse seine catch, were also relatively strong during the North Shelikof fishery (Figure 5). Runs within proximate distance, which were non-local Kodiak stocks (Chignik and Upper Cook Inlet), were strong and at peak abundance during the adjusted time to the Shelikof fishery (Figure 5).

Table 3. Classification accuracy, model type, and variables used for classifying 1990 North Shelikof Strait, age 2.3 sockeye salmon commmerical catch samples.

Model Number	N	Actual Stock Of Origin	Classified Stock Of Origin				
			COOK1	Chignik	Frazer	Malina	Red River
1	----	COOK1	----	----	----	----	----
	----	Chignik	----	----	----	----	----
	----	Frazer	----	----	----	----	----
	91	Malina	----	----	----	84 (92.31%)	7 (7.69%)
	62	Red River	----	----	----	0 (0.0%)	62 (100.0%)

$\overline{X}_{cc}{}^a$ = 96.16% (QDF with variables V1-V8, V10-V12)

2	195	COOK1	160 (82.05%)	----	29 (14.87%)	6 (3.08%)	----
	----	Chignik	----	----	----	----	----
	66	Frazer	4 (6.06%)	----	60 (90.91%)	2 (3.03%)	----
	91	Malina	9 (9.89%)	----	7 (7.69%)	75 (82.42%)	----
	----	Red River	----	----	----	----	----

$\overline{X}_{cc}{}^a$ = 85.13% (QDF with variables V1-V8, V10-V12)

3	195	COOK1	149 (76.41%)	20 (10.26%)	26 (13.33%)	----	----
	206	Chignik	16 (7.77%)	181 (87.86%)	9 (4.37%)	----	----
	66	Frazer	0 (0.00%)	5 (7.58%)	61 (92.42%)	----	----
	----	Malina	----	----	----	----	----
	----	Red River	----	----	----	----	----

$\overline{X}_{cc}{}^a$ = 85.56% (QDF with variables V1-V8, V10-V12)

4	195	COOK1	169 (86.67%)	26 (13.33%)	----	----	----
	206	Chignik	20 (9.71%)	186 (90.29%)	----	----	----
	----	Frazer	----	----	----	----	----
	----	Malina	----	----	----	----	----
	----	Red River	----	----	----	----	----

$\overline{X}_{cc}{}^a$ = 88.48% (QDF with varibles V1-V8, V10-V12)

[a]Mean classification accuracy.
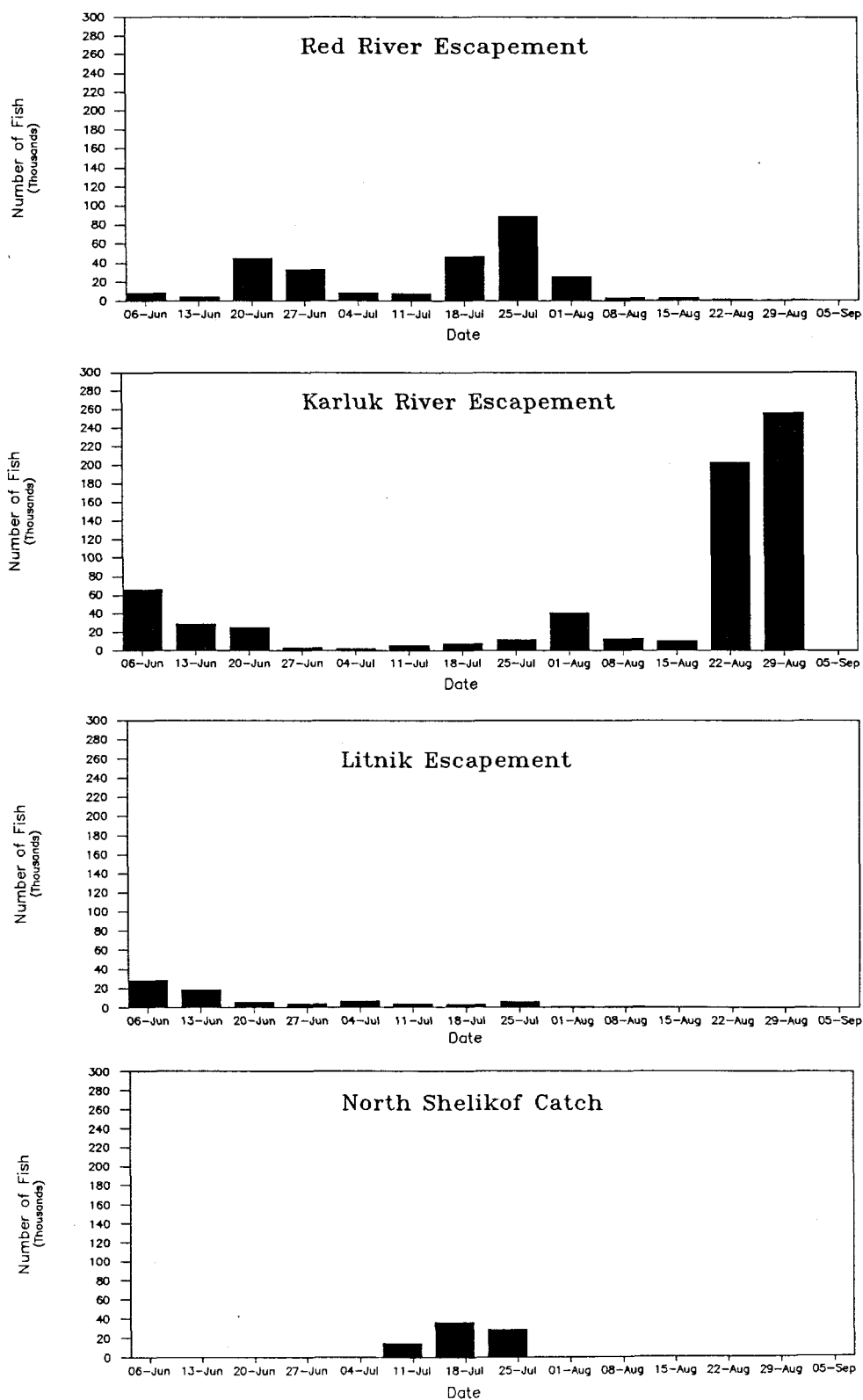
Figure 3. Comparison of the weekly sockeye salmon
escapements in selected Kodiak systems
(adjusted to North Shelikof Strait time)
to the catch in North Shelikof Strait,
1990.   − 19 −
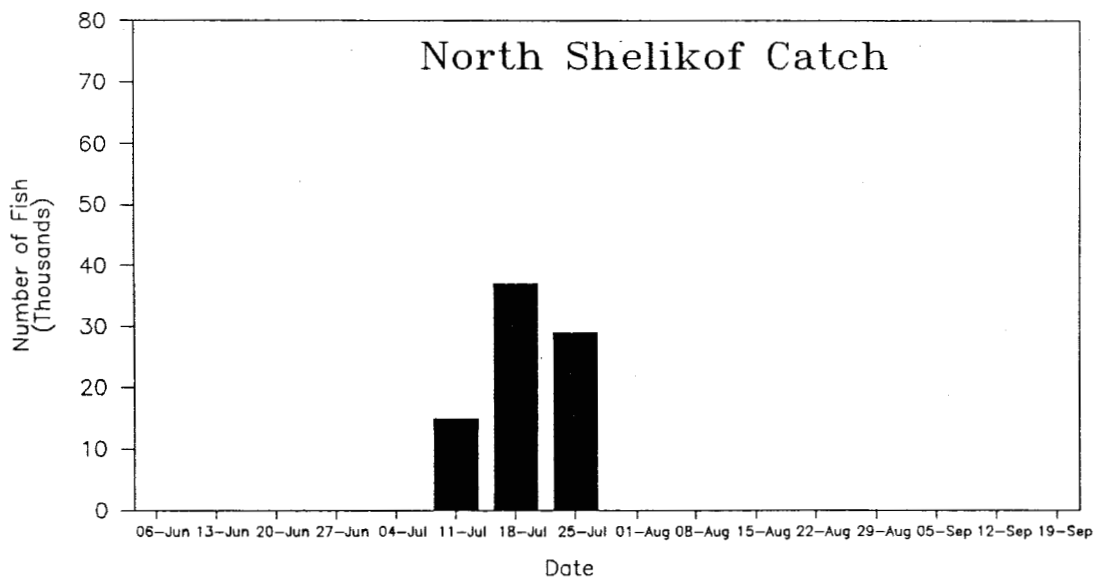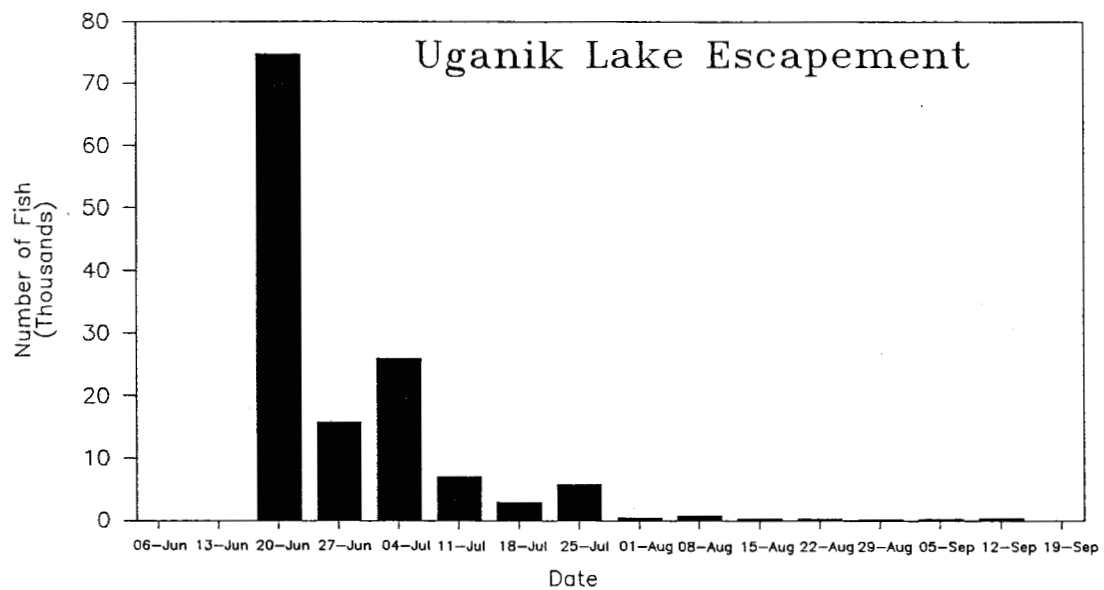
Figure 4. Comparison of the weekly sockeye salmon escape-
ment in Uganik Lake (adjusted to North Shelikof
Strait time) to the catch in North Shelikof
Strait, 1990.
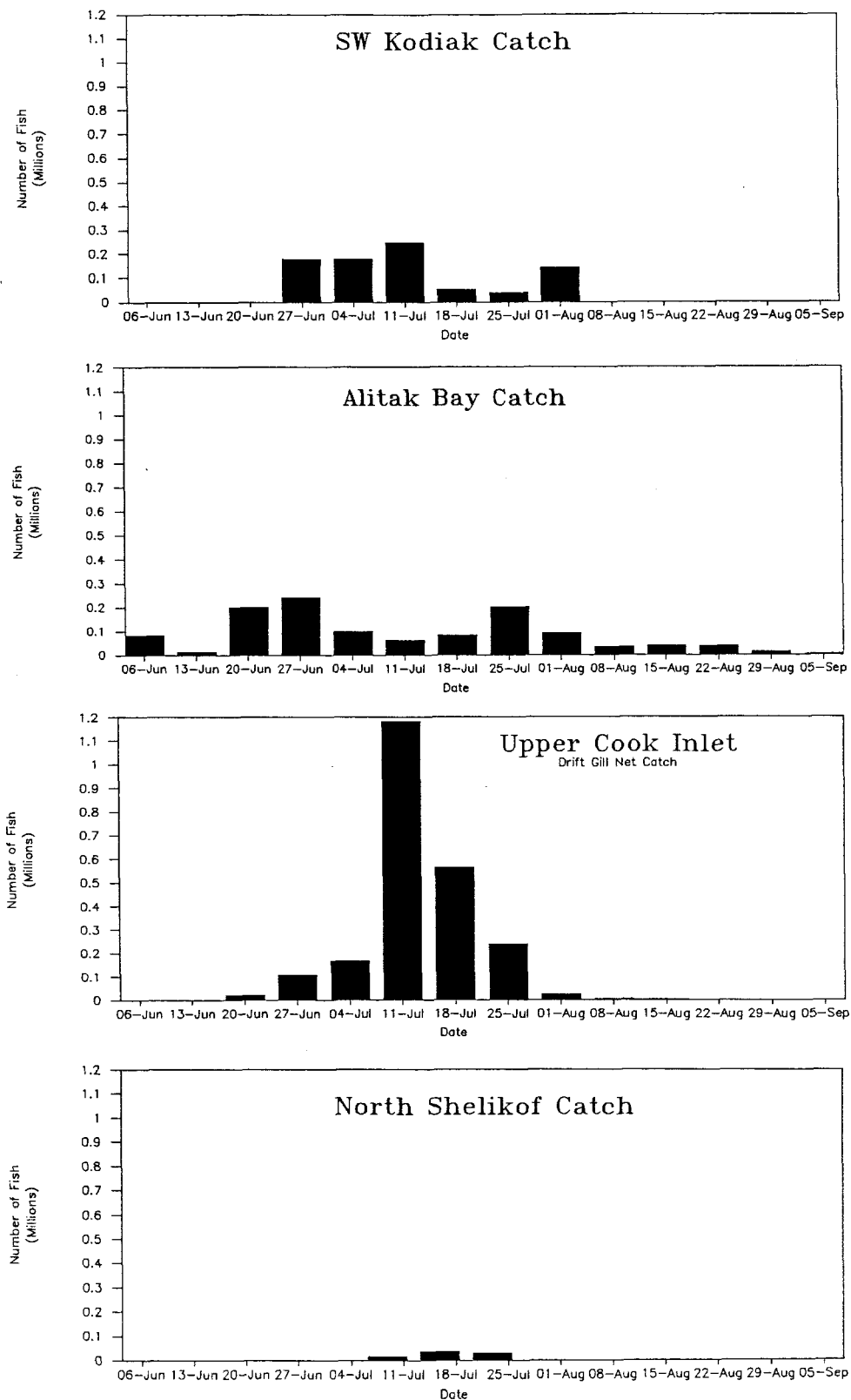
Figure 5. Comparison of the weekly sockeye salmon
catch in selected terminal fisheries
(adjusted to North Shelikof Strait time)
to the catch in North Shelikof Strait,
1990.
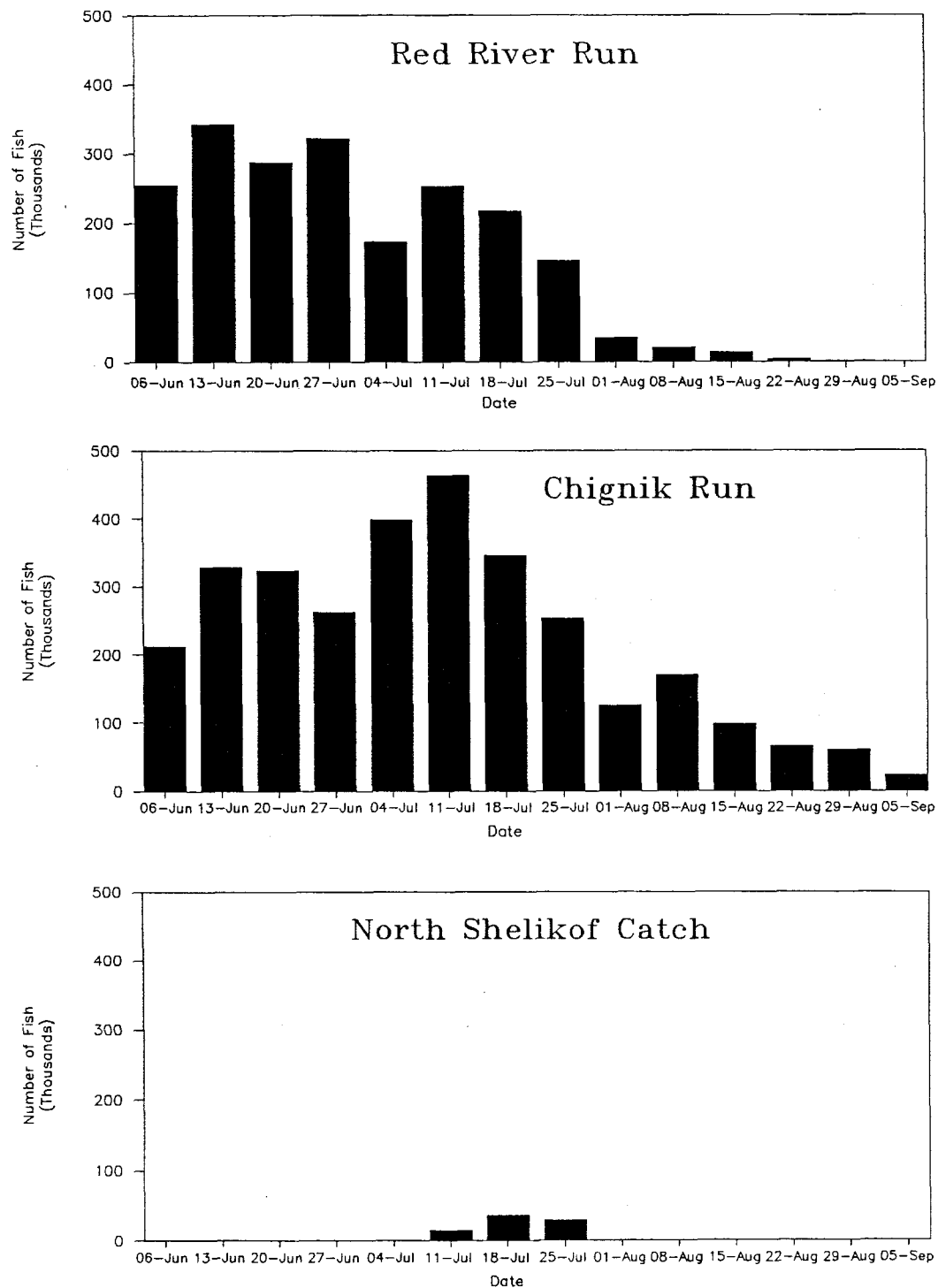
Figure 6.   Comparison of the weekly sockeye salmon run
             numbers for the Red River and Chignik River
             systems (adjusted to North Shelikof Strait
             time) with the North Shelikof Strait catch,
             1990.

Weight Data

In mixed stock fisheries average whole fish weight statistics may be used for qualitative assessment of stock contribution levels when differences exist between potential stock contributors. Average fish weights for the North Shelikof Strait Mainland and Afognak Districts and selected stocks are presented in Figure 7.

In the Mainland District sockeye catch, the average whole fish weight was 6.3 lbs. as compared to the Afognak District average of 5.3 lbs., a 20% difference. Upper Cook Inlet fish averaged 6.5 lbs., Chignik 7.1 lbs., and Kodiak 5.2 lbs. Closest alignment of average weights were Mainland District-Cook Inlet and Afognak District-Kodiak.

Length

Age specific length data can also be used for qualitative analysis of stock contributions in mixed stock fishery samples. Median lengths for the North Shelikof Strait Mainland and Afognak Districts and selected stocks are provided in Figures 8 and 9.

Median age 1.3 and 2.3 lengths were disparate between catch areas and major stock groups. In the North Shelikof Strait within the Mainland and Afognak Districts, median age 1.3 fish lengths differed by 12 mm (579 mm versus 567 mm). Age 1.3 length for the Mainland District catch (579mm) was within 4mm of the Cook Inlet median (575mm), and within 11mm and 15mm of the Kodiak medians as represented
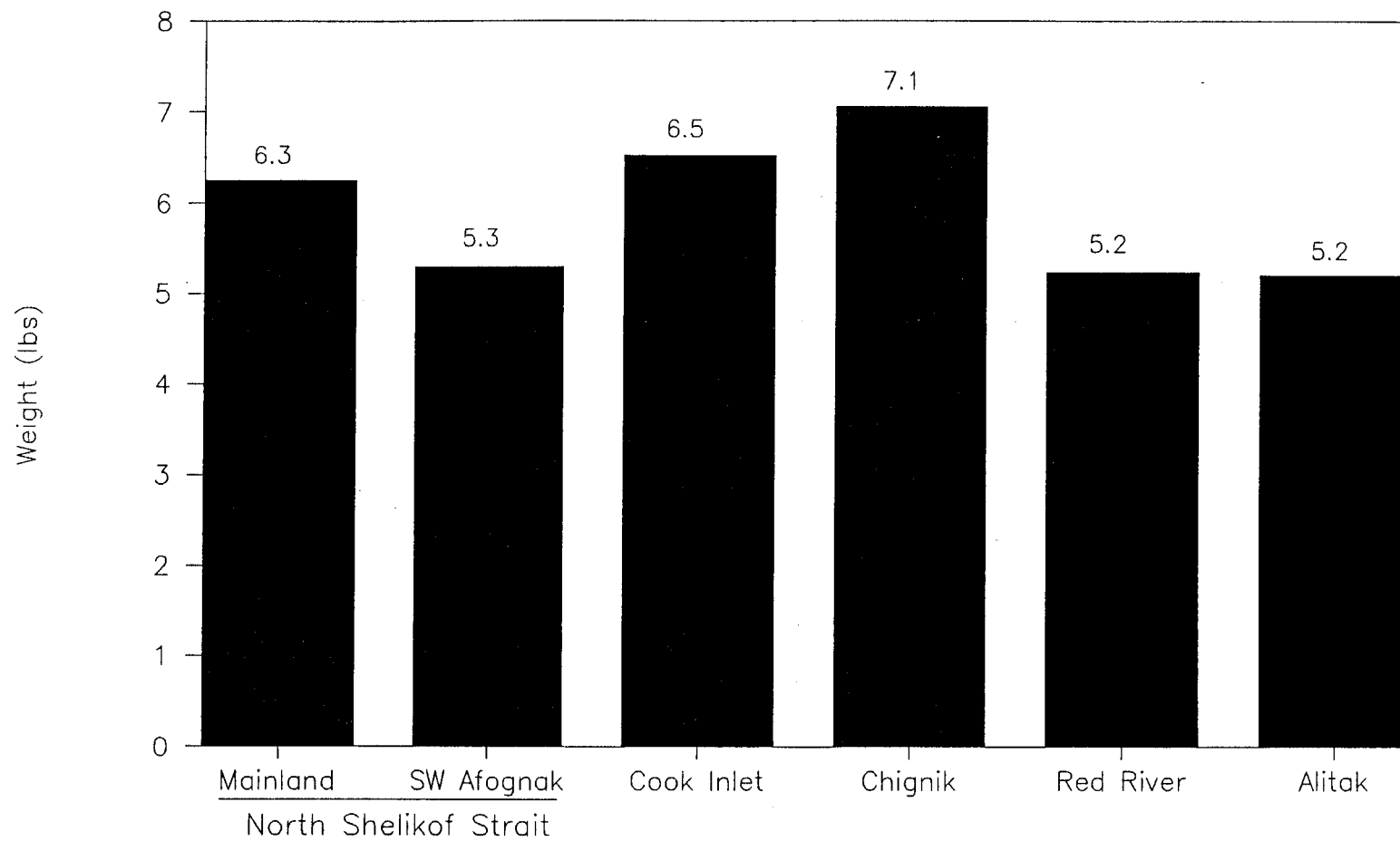
Figure 7. Sockeye salmon average weights (in pounds) from selected catch areas during the time adjusted to the North Shelikof Strait fishery, 1990.
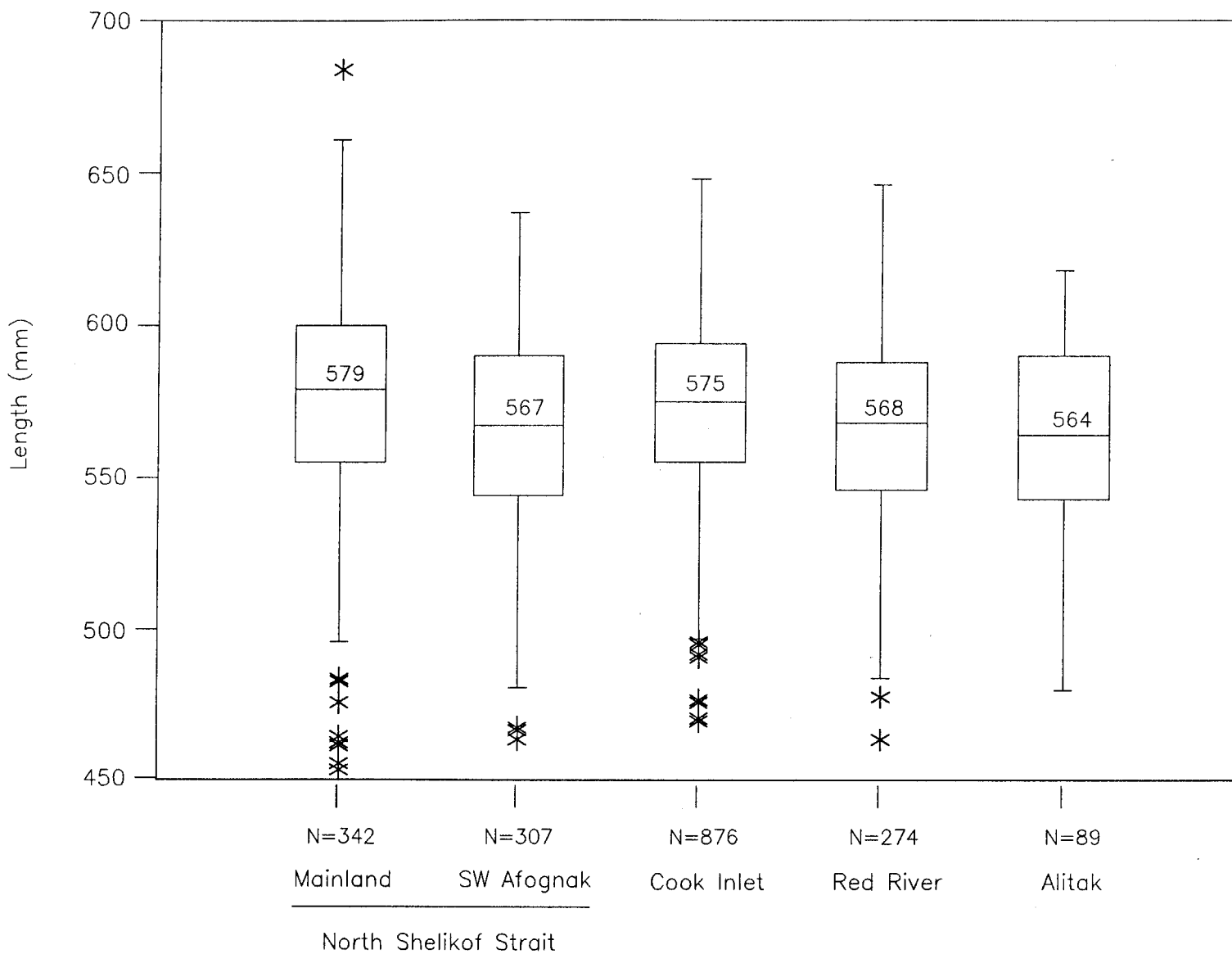
Figure 8. Median, inter-quartile range, and range of age 1.3 sockeye salmon lengths sampled in the North Shelikof Strait portion of the Mainland and Afognak Districts, Cook Inlet, and selected Kodiak areas, 1990.
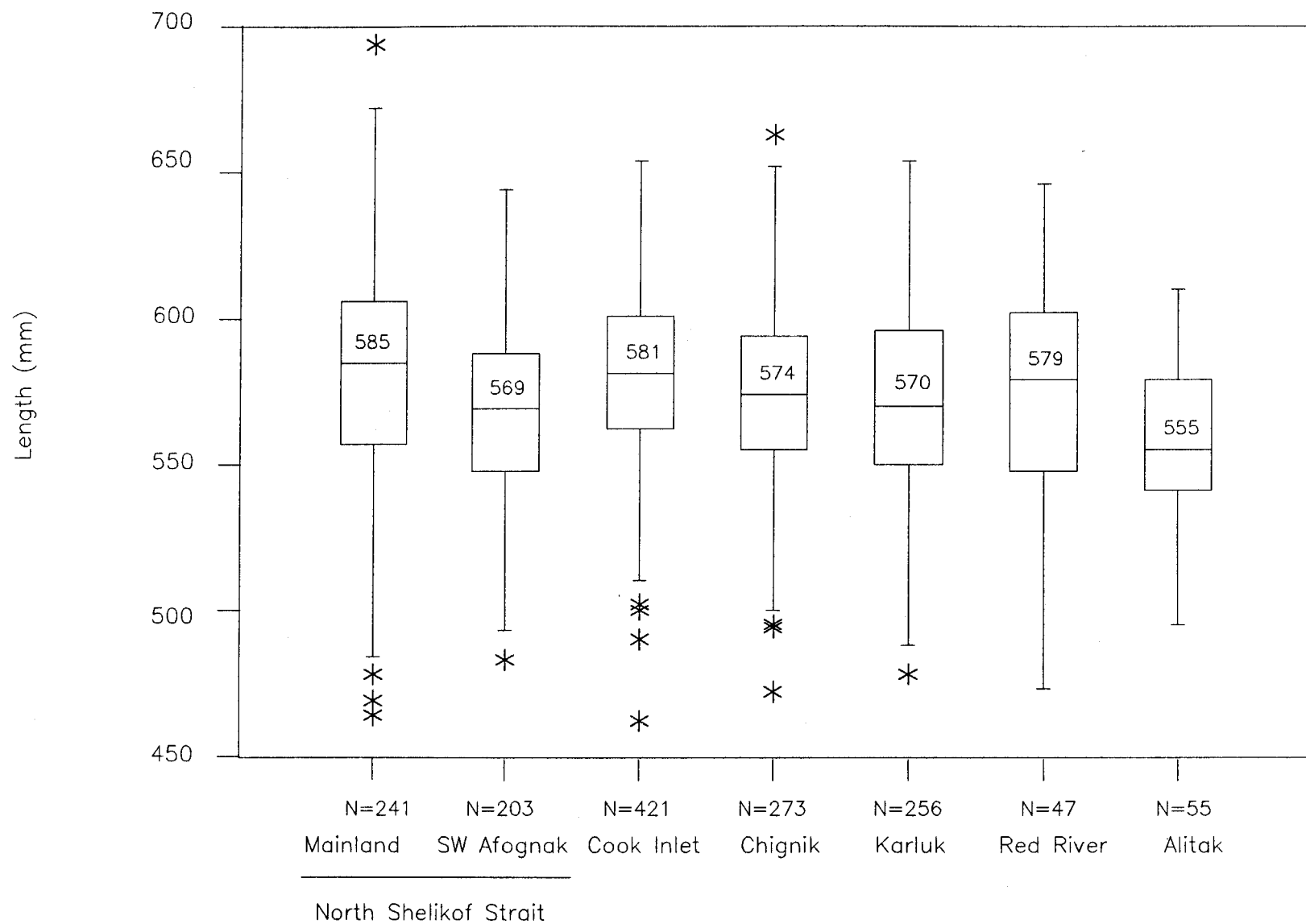
Figure 9. Median, inter-quartile range, and range of age 2.3 sockeye salmon lengths sampled in the North Shelikof Strait portion of the Mainland and Afognak Districts, Cook Inlet, Chignik, and selected Kodiak areas, 1990.

by Red River (568mm) and Alitak (564mm) stocks. In the Afognak District catch, age 1.3 length (567mm) was 8mm less than Cook Inlet (575mm) and within 1mm and 3mm of the Red River (568mm) and Alitak (564mm) median lengths, respectively. A similar pattern for the age 2.3 fish was present. Age 2.3 median length for the Mainland District (585mm) was closer to the median length for Cook Inlet (580mm) than for Kodiak (Karluk 570mm, Red River 579mm, and Alitak Bay 555mm) and Chignik (574mm). Median length within the Afognak District (569mm) was 12mm less than Cook Inlet (581mm) but within 1mm of the Kodiak (Karluk 570mm, Red River 579mm, and Alitak Bay 555mm) lengths combined.

Age

The North Shelikof Strait catch was 35% age 1.3, 18% age 2.2, and 23% age 2.3 (Table 4). These ages were present in the Chignik run, Upper Cook Inlet drift gill net catch, and Kodiak escapement and terminal catches during the time adjusted to the Shelikof fishery (Appendix A). For Kodiak, the main catch areas were the Alitak Bay District (Late Upper Station and Frazer runs) and Southwest Kodiak District (Red River run).

Age class compositions for the Kodiak terminal catch and Cook Inlet drift gill net catch were not disparate enough to provide an age class marker to determine actual stock contribution levels for the North Shelikof Strait catch. However the 3-ocean components were dissimilar enough, as measured by the relative frequency of age 1.3 and 2.3 fish, to indicate a qualitative difference among the major stock groups (Kodiak, Cook Inlet, and Chignik). The relative frequency of age 1.3 and 2.3 fish in the North Shelikof Strait Mainland and Afognak Districts, more closely approximated the Cook Inlet stock than Chignik and Kodiak

Table 4. Age composition of the North Shelikof Strait sockeye salmon catch by period, 1990.

Period	Sample Size		Age													Total
			0.2	1.1	0.3	1.2	2.1	1.3	2.2	1.4	2.3	3.2	2.4	3.3	2.5	
Mainland District																
7/6-7/17	515	Number	0	65	845	6,042	390	13,513	4,223	65	7,601	325	260	65	65	33,458
		Percent	0.00	0.00	0.03	0.18	0.01	0.40	0.13	0.00	0.23	0.01	0.01	0.00	0.00	1.00
7/18-7/25	408	Number	94	0	468	2,809	47	6,366	3,183	47	5,805	47	234	0	0	19,099
		Percent	0.00	0.00	0.02	0.15	0.00	0.33	0.17	0.00	0.30	0.00	0.01	0.00	0.00	1.00
Afognak District																
7/6-7/17	607	Number	48	160	385	3,702	256	5,305	4,456	16	3,606	272	16	96	0	18,320
		Percent	0.00	0.01	0.02	0.20	0.01	0.29	0.24	0.00	0.20	0.01	0.00	0.01	0.00	1.00
7/18-7/25	536	Number	26	86	205	1,977	137	2,832	2,379	9	1,925	145	9	51	0	9,781
		Percent	0.00	0.01	0.02	0.20	0.01	0.29	0.24	0.00	0.20	0.01	0.00	0.01	0.00	1.00
Total		Number	167	311	1,903	14,530	830	28,017	14,241	136	18,937	790	519	212	65	80,658
		Percent	0.00	0.00	0.02	0.18	0.01	0.35	0.18	0.00	0.23	0.01	0.01	0.00	0.00	1.00

stocks (Figure 10). Although Alitak Bay stocks were a close second, age 1.3 and 2.3 fish comprised a relatively small percentage (20%) of the Alitak Bay District catch, while in the Cook Inlet catch these ages were dominant (80%).

Scale Patterns

Based on age 1.3 scale pattern analyses the North Shelikof Strait catch was mostly Cook Inlet fish. In the Mainland District for the second fishing period, 13 July through 16 July, the age 1.3 catch was an estimated 90.1% Cook Inlet and 9.9% Kodiak fish, while for the third fishing period, 20 July through 23 July, the composition was 100% Cook Inlet and 0% Kodiak fish (Table 5). For the Afognak District, the second period catch was 100% Cook Inlet and 0% Kodiak fish, and third period catch was 86.7% Cook Inlet and 13.3% Kodiak fish.

Age 2.3 scale patterns also indicate a dominance of Cook Inlet fish. The Mainland District catch during the second period was an estimated 50.9% Cook Inlet, 39.8% Chignik and 9.2% Kodiak fish, while the third period catch was 82.0% Cook Inlet and 18.0% Chignik fish (Table 6). The Afognak District catch for the second period was 100% Kodiak and 0% Cook Inlet, while the third period was 76.5% Cook Inlet and 23.5% Kodiak sockeye.

To estimate stock composition for the total North Shelikof Strait catch for all periods, two assumptions must be made: 1) stock composition estimates derived from the second period are equal to the first period; and 2) age 1.3 and 2.3 stock composition combined is applicable for all other age classes present. Following these assumptions, the Mainland District catch for 6 July through 25 July was approximately 42,164 (80.2%) Cook Inlet, 6,435 (12.2%) Chignik, and
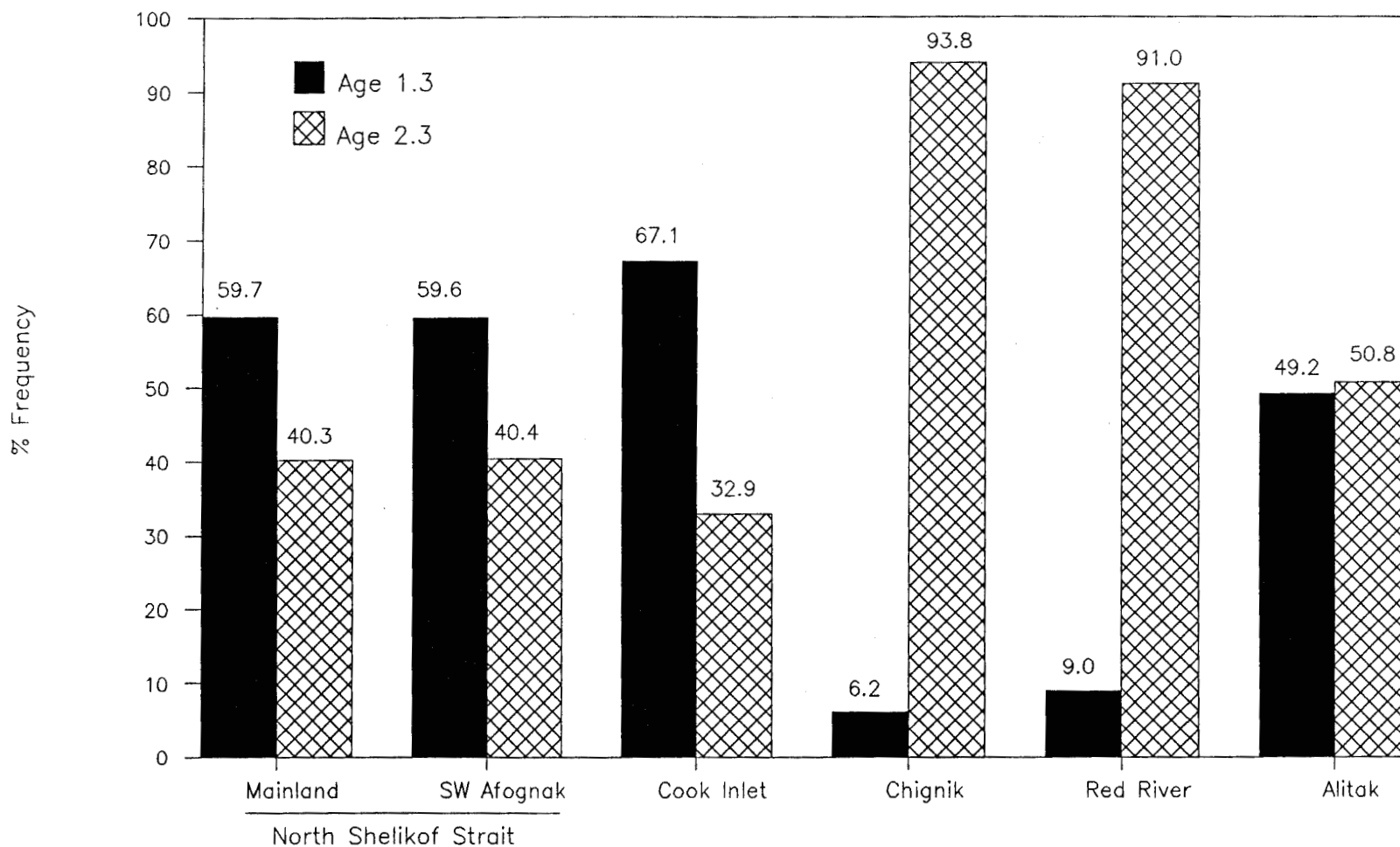
Figure 10. The relative frequency, in percent, of age 1.3 and age 2.3 sockeye salmon in the North Shelikof Strait portion of the Mainland and Afognak Districts compared to other areas (adjusted to North Shelikof Strait time of 6-25 July), 1990.

Table 5.   Corrected mixed stock proportions for 1990 North Shelikof Strait age 1.3 samples collected from the Dakavak and Southwest Afognak Sections, Kodiak Management Area.

Area	Date	Model Number	N	Mixed Stock Proportions								
				COOK1			COOK2			Red River		
				Est.	SE	90%CC[a]	Est.	SE	90%CC[a]	Est.	SE	90%CC[a]
S.W. Afognak	7/13-7/16	1	104	1.0	0.013	±.144	----	----	----	0.0	.013	±.144
S.W. Afognak	7/20-7/23	2	129	----	----	----	0.867	.010	±.126	0.133	.010	±.126
Mainland	7/13-7/16	1	146	0.901	0.011	±.137	----	----	----	0.099	.011	±.137
Mainland	7/20-7/23	2	102	----	----	----	1.0	.012	±.129	0.0	.012	±.129

[a]Confidence coefficient.

Note: Hash marks represent stocks not present in classification model.

Table 6.   Corrected mixed stock proportions for 1990 North Shelikof Strait age 2.3 samples collected from the Dakavak and Southwest Afognak Sections, Kodiak Management Area.

Section	Date	Model Number	N	COOK1			Chignik			Frazer			Malina			Red River		
				Est.	SE	90%CC[a]	Est.	SE	90%CC[a]	Est.	SE	90%CC[a]	Est.	SE	90%CC[a]	Est.	SE	90%CC[a]
S.W. Afognak	7/13-7/16	1	54	----	----	----	----	----	----	----	----	----	0.180	0.011	±.091	0.820	0.011	±.091
S.W. Afognak	7/20-7/23	2	91	0.765	0.015	±.157	----	----	----	0.08	0.012	±.129	0.155	0.010	±.107	----	----	----
Mainland	7/13-7/16	3	88	0.509	0.016	±.167	0.398	0.015	±.150	0.092	0.011	±.110	----	----	----	----	----	----
Mainland	7/20-7/23	4	70	0.820	0.013	±.122	0.180	0.013	±.122	----	----	----	----	----	----	----	----	----

Mixed Stock Proportions

[a]Confidence coefficient.

Note: Hash marks delineate stocks not present in classification model.

3,958 (7.5%) Kodiak bound fish (Table 7). For the Afognak District, sockeye catch was 19,005 (67.6%) Cook Inlet, and 9,096 (32.3%) Kodiak fish. For both areas in composite, 61,169 (75.8%) fish were of Cook Inlet origin, 6,435 (8.0%) were bound for Chignik, and 13,054 (16.2%) destined for Kodiak systems.

DISCUSSION

Average whole weights, median length, age 1.3 and 2.3 catch proportions, and catch timing data qualitatively indicate that Cook Inlet fish dominated the North Shelikof Strait sockeye catch. Cook Inlet sockeye numbers were proportionally stronger in the Mainland District than in the Afognak District catch. Conversely, Kodiak sockeye numbers were greater in the Afognak District than in the Mainland District. Among the Kodiak stocks, Red River was the largest contributor.

For the age classes evaluated, scale pattern analysis confirmed that Cook Inlet sockeye salmon were the dominant stock of the North Shelikof Strait catch in the Mainland and Afognak Districts, and Red River was the largest Kodiak stock component. Chignik sockeye salmon contributed to the Mainland District catch, but were absent in the Afognak District catch. Cook Inlet fish were more numerous in the Mainland District than in the Afognak District, while the converse was true for Kodiak stocks.

The scale pattern analysis estimates should be considered accurate but not necessarily precise. The models developed probably overestimated the Cook Inlet contribution and conversely under estimated the Kodiak contribution. The late Upper Station stock was excluded from the age 1.3 model due to a large

Table 7. Estimated sockeye salmon stock composition of the North Shelikof Strait 6 July through 25 July catch, in numbers of fish and percent, based on scale pattern analysis of ages 1.3 and 2.3 fish, 1990.

North Shelikof Strait Area	Time Period		Cook Inlet	Chignik River	Red River	Malina Lake	Frazer Lake	Total
Mainland District								
	6 July - 17 July	#	24,705	4,796	2,849		1,109	33,458
		%	73.8	14.3	8.5		3.3	100.0
	18 July - 25 July	#	17,459	1,640	0		0	19,099
		%	91.4	8.6	0.0		0.0	100.0
	6 July - 25 July	#	42,164	6,435	2,849		1,109	52,557
		%	80.2	12.2	5.4		2.1	100.0
Afognak District								
	6 July - 17 July	#	10,929		6,061	1,330	0	18,320
		%	59.7		33.1	7.3	0.0	100.0
	18 July - 25 July	#	8,076		773	615	317	9,781
		%	82.6		7.9	6.3	3.2	100.0
	6 July - 25 July	#	19,005		6,834	1,945	317	28,101
		%	67.6		24.3	6.9	1.1	100.0
Total	6 July - 25 July	#	61,169	6,435	9,683	1,945	1,426	80,658
		%	75.8	8.0	12.0	2.4	1.8	100.0

misclassification of Upper Station to Cook Inlet stocks (41% versus 7%). The
Upper Station stock probably contributed to the catch based on the presence of
this stock in the 1988 fishery (Barrett 1989a).

LITERATURE CITED

Anas, R.E., and S. Murai. 1969. Use of scale characters and a discriminant function for classifying sockeye salmon (*Oncorhynchus nerka*) by continent of origin. International North Pacific Fisheries Commission, Bulletin 26:157-192.

Barrett, B.M. 1989a. North Shelikof Strait 1988 sockeye catch--distribution, timing, and stock composition. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-6, Kodiak.

Barrett, B.M. 1989b. Chignik Management Area salmon catch and escapement statistics, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 89-05, Juneau.

Bilton, H.T., and H.B. Messinger. 1975. Identification of major British Columbia and Alaska runs of age 1.2 and 1.3 sockeye from their scale patterns. International North Pacific Fisheries Commission, Bulletin 32:109-129.

Box, G.E.P. 1949. A general distribution theory for a class of likelihood criteria. Biometrica 36:317-346.

Clutter, R., and L. Whitesel. 1956. Collection and interpretation of sockeye salmon scales. International Pacific Salmon Fisheries Commission, Bulletin 9, New Westminster, British Columbia.

Conrad, R.H. 1984. Management applications of scale pattern analysis methods for the sockeye salmon runs to Chignik, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 233, Juneau.

Cook, R.C. 1982. Estimating the mixing proportion of salmonoids with scale pattern recognition applied to sockeye salmon (*Oncorhynchus nerka*) in and around the Japanese landbased drift net fishery area. Ph.D. dissertation. University of Washington, Seattle.

Cook, R.C., and G. Lord. 1978. Identification of stocks of Bristol Bay sockeye salmon by evaluating scale patterns with a polynomial discriminant method. U.S. Fish and Wildlife Service, Fisheries Bulletin 76(2):415-423.

Davis, N.D. 1987. Variable selection and performance of variable subsets in scale pattern analysis. Rept. submitted to INPFC 1987. Fisheries Research Institute, University of Washington, Seattle.

Fisher, R. 1936. The use of multiple measurements in taxonomic problems. Annals of Eugenics 7:179-188.

Holmes, P.B., and B.E. Monkiewicz. 1988. Catch and escapement statistics for Kodiak Management Area sockeye and coho salmon, 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 88-09, Juneau.

LITERATURE CITED (Continued)

Koo, T.S.Y. 1962. Studies of Alaska red salmon. University of Washington, Publications in Fisheries, New series, Vol.I. Seattle.

Lachenbrunch, P. 1967. An almost unbiased method of obtaining confidence intervals for the probability of misclassification in discriminant analysis. Biometrics 23(4):635-645.

Malloy, L. 1988. Interception of Cook Inlet-bound sockeye in the 1988 Kodiak commercial salmon fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 4K88-7, Kodiak.

Moser, K. 1969. Identification of Pacific salmon and steelhead trout by scale characteristics. U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Circular 317.

Myers, K.W., and five coauthors. 1987. Stock origins of chinook salmon in the area of the Japanese mothership salmon fishery. North American Journal of Fisheries Management 7:459-474.

Narver, D.W. 1963. Identification of adult red salmon groups by lacustrine scale measurement, time of entry, and spawning characteristics. M.S. thesis, University of Washington, Seattle.

Pella, J., and T. Robertson. 1979. Assessment of composition of stock mixtures. Fisheries Bulletin 77(2):387-398.

Smith, C.A.B. 1947. Some examples of discrimination. Annals of Eugenics 13:272-282.

Thompson, S.K. 1987. Sample size for estimating multinominal proportions. The American Statistician 41:42-46.

Waltemyer, D.L. 1989. Age and size composition of chinook, sockeye, coho, and chum salmon returning to Upper Cook Inlet, Alaska, in 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fishery Report 89-18, Juneau.

APPENDIX

Appendix A.1. Age composition of the North Shelikof, Mainland sockeye catch samples by statistical week, 1990.

Statistical Week		0.2	0.3	1.1	1.2	1.3	1.4	Age 2.1	2.2	2.3	2.4	2.5	3.2	3.3	Total
	28	0	13	1	93	208	1	6	65	117	4	1	5	1	515
	30	2	10	0	60	136	1	1	68	124	5	0	1	0	408
Total	Number	2	23	1	153	344	2	7	133	241	9	1	6	1	923
	Percent	0	2	0	17	37	0	1	14	26	1	0	1	0	

Appendix A.2. Age composition of the North Shelikof, SW Afognak sockeye catch samples statistical week 29, 1990.

Statistical Week		0.2	0.3	1.1	1.2	1.3	1.4	Age 2.1	2.2	2.3	2.4	3.2	3.3	Total
29	Number	3	24	10	231	331	1	16	278	225	1	17	6	1,143
	Percent	0	2	1	20	29	0	1	24	20	0	1	1	

Appendix A.3. Age composition of the Frazer River sockeye escapement by statistical week, 1990.[a]

Statistical Week	Sample Size		1.1	1.2	2.1	1.3	Age 2.2	3.1	2.3	3.2	3.3	Total
26	208	Percent	0.0	69.7	2.5	5.7	7.6	0.0	9.3	0.4	4.7	100.0
		Numbers	0	55,898	1,992	4,597	6,089	0	7,431	345	3,792	80,145
27	220	Percent	0.0	74.9	3.1	5.5	4.6	0.0	7.4	0.2	4.3	100.0
		Numbers	5	59,104	2,422	4,376	3,616	5	5,825	129	3,388	78,872
28	220	Percent	0.3	76.5	10.5	4.8	3.0	0.3	2.4	0.0	2.3	100.0
		Numbers	10	2,407	329	151	95	9	76	0	71	3,148
29	218	Percent	1.1	79.1	12.9	2.4	2.8	0.1	1.1	0.0	0.6	100.0
		Numbers	193	14,398	2,341	439	503	21	203	0	107	18,204
30	216	Percent	0.4	77.5	5.0	4.1	5.2	0.0	4.9	0.0	2.9	100.0
		Numbers	92	18,456	1,197	970	1,241	0	1,169	0	702	23,827
31	218	Percent	0.4	78.5	4.2	4.4	4.8	0.0	5.0	0.0	2.8	100.0
		Numbers	57	12,418	671	690	752	0	790	0	437	15,815
32	220	Percent	1.2	82.5	7.0	3.3	3.6	0.0	1.4	0.0	1.1	100.0
		Numbers	26	1,836	155	73	81	0	31	0	25	2,226
33	207	Percent	0.7	85.3	7.2	2.6	2.7	0.0	0.6	0.0	1.0	100.0
		Numbers	31	4,030	342	121	126	0	27	0	45	4,723
Total	1,727	Percent	0.2	74.3	4.2	5.0	5.5	0.0	6.9	0.2	3.8	100.0
		Numbers	414	168,547	9,449	11,417	12,503	35	15,552	474	8,567	226,960

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.4.   Age composition of the Kaflia Lake sockeye escapement samples, statistical week 28, 1990.

Statistical Week	Sample Size		Age						Total
			1.1	1.2	1.3	2.1	2.2	2.3	
28	519	Number	1	314	32	24	146	2	519
		Percent	0	61	6	5	28	0	100.0

Appendix A.5. Age composition of the Karluk River early run sockeye escapement by statistical week, 1990.[a]

Statistical Week	Sample Size		0.2	0.3	1.2	2.1	1.3	2.2	3.1	2.3	3.2	2.4	3.3	Total
22	0	Percent	0.0	0.6	4.7	0.6	2.7	27.4	0.6	50.3	7.2	0.6	5.7	100.0
		Numbers	0	3	23	3	13	134	3	246	35	3	28	489
23	193	Percent	0.0	0.5	4.5	0.5	2.5	27.8	0.6	49.0	8.2	0.5	5.9	100.0
		Numbers	13	123	1,181	135	665	7,294	161	12,836	2,137	123	1,541	26,208
24	198	Percent	0.3	0.2	3.5	0.5	2.2	30.2	1.2	41.0	13.7	0.2	6.9	100.0
		Numbers	282	135	2,938	438	1,819	25,188	1,003	34,138	11,436	135	5,770	83,282
25	189	Percent	0.2	0.0	2.5	1.2	1.4	36.7	1.6	34.1	17.2	0.0	5.2	100.0
		Numbers	80	0	998	479	581	14,903	640	13,872	6,977	0	2,122	40,652
26	191	Percent	0.0	0.0	0.4	2.8	0.6	34.6	2.8	36.8	18.3	0.0	3.7	100.0
		Numbers	0	0	138	926	209	11,358	930	12,079	5,998	0	1,212	32,850
27	207	Percent	0.0	0.0	0.6	2.4	0.8	29.2	2.6	49.4	10.9	0.0	4.1	100.0
		Numbers	0	0	41	159	55	1,972	179	3,342	738	0	274	6,761
28	205	Percent	0.0	0.0	1.0	0.9	1.7	27.8	1.0	58.9	6.0	0.0	2.6	100.0
		Numbers	0	0	18	16	30	505	19	1,069	109	0	48	1,814
29	241	Percent	0.0	0.3	0.9	0.1	1.4	29.6	0.4	57.3	6.5	0.3	3.1	100.0
		Numbers	0	14	36	5	56	1,227	18	2,374	270	14	128	4,141
30	286	Percent	0.0	0.1	1.0	1.2	0.8	30.0	0.9	56.1	6.9	0.1	2.9	100.0
		Numbers	0	4	55	63	42	1,618	51	3,021	374	4	155	5,386
Total	1,710	Percent	0.2	0.1	2.7	1.1	1.7	31.8	1.5	41.2	13.9	0.1	5.6	100.0
		Numbers	375	279	5,428	2,224	3,470	64,199	3,004	82,977	28,074	279	11,278	201,583

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Statistical Week	Sample Size		Age 0.2	0.3	1.2	2.1	1.3	2.2	3.1	2.3	3.2	2.4	3.3	Total
31	206	Percent	0.0	0.0	1.9	·0.0	1.0	50.0	0.0	38.8	7.3	0.5	0.5	100.0
		Numbers	0	0	207	0	103	5,323	0	4,134	775	52	52	10,646
32	207	Percent	0.0	0.0	0.8	0.4	1.0	63.4	0.0	29.0	4.7	0.1	0.5	100.0
		Numbers	2	0	167	72	193	12,751	2	5,837	951	24	106	20,105
33	200	Percent	0.2	0.0	0.3	0.3	0.7	70.6	0.2	21.4	4.6	0.0	1.6	100.0
		Numbers	72	1	81	81	235	22,121	72	6,719	1,448	0	515	31,345
34	200	Percent	0.1	0.4	0.0	0.0	0.5	70.5	0.1	22.1	4.7	0.0	1.5	100.0
		Numbers	15	45	2	0	62	8,432	15	2,640	566	0	185	11,962
35	198	Percent	0.0	0.5	0.9	0.0	1.9	57.2	0.0	32.1	3.4	0.0	3.9	100.0
		Numbers	14	254	426	0	907	27,397	0	15,388	1,648	14	1,886	47,933
36	238	Percent	0.2	0.7	0.5	0.0	1.6	50.1	0.0	33.7	8.6	0.2	4.4	100.0
		Numbers	428	1,299	885	0	3,055	94,976	0	63,856	16,339	428	8,249	189,514
37	0	Percent	0.4	0.8	0.0	0.0	1.3	43.7	0.0	34.9	13.9	0.4	4.6	100.0
		Numbers	945	1,891	0	0	2,836	98,319	0	78,466	31,197	945	10,399	225,000
Total	1,249	Percent	0.3	0.7	0.3	0.0	1.4	50.2	0.0	33.0	9.9	0.3	4.0	100.0
		Numbers	1,476	3,490	1,768	153	7,391	269,319	89	177,040	52,924	1,463	21,392	536,505

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.7.   Age composition of the Little River sockeye escapement samples statistical week 24, 1990.

Statistical Week	Sample Size		Age						Total
			1.2	1.3	2.1	2.2	2.3	3.3	
24	286	Number	14	18	11	204	38	1	286
		Percent	5	6	4	71	13	0	100.0

Appendix A.8.   Age composition summary of the Malina Lake sockeye escapement samples, statistical week 31, 1990.

Statistical Week	Sample Size		Age						Total
			1.2	2.1	2.2	2.3	2.4	3.2	
31	508	Number	109	12	381	1	1	4	508
		Percent	21	2	75	0	0	1	100.0

Appendix A.9. Age composition of the Red River early run sockeye escapement by statistical week, 1990.[a]

Statistical Week	Sample Size		Age										Total
			0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	
22	0	Percent	0.0	0.5	14.0	6.8	1.9	0.5	57.0	17.9	0.0	1.4	100.0
		Numbers	0	48	1,405	678	194	48	5,719	1,793	0	145	10,032
23	207	Percent	0.0	0.4	13.2	7.7	1.7	0.4	57.6	17.3	0.0	1.5	100.0
		Numbers	0	371	11,241	6,592	1,482	371	49,176	14,784	0	1,318	85,334
24	209	Percent	0.0	0.2	9.2	12.5	1.0	0.2	60.5	14.5	0.0	2.0	100.0
		Numbers	0	20	1,001	1,371	105	20	6,609	1,587	0	218	10,931
25	22	Percent	0.0	0.0	15.6	12.1	7.9	0.0	50.2	13.1	0.0	1.0	100.0
		Numbers	0	0	519	402	263	0	1,670	437	0	33	3,324
26	218	Percent	0.0	2.7	6.0	5.9	2.6	0.4	45.8	28.8	0.8	7.0	100.0
		Numbers	0	818	1,849	1,815	790	117	14,058	8,838	246	2,137	30,668
27	225	Percent	0.0	1.5	2.6	8.4	0.8	0.2	41.2	38.2	0.6	6.5	100.0
		Numbers	0	663	1,201	3,828	375	87	18,796	17,413	286	2,943	45,591
28	216	Percent	0.0	2.6	1.2	7.5	1.3	0.0	32.8	47.3	0.1	7.1	100.0
		Numbers	3	198	87	559	100	3	2,454	3,545	10	530	7,489
29	222	Percent	0.3	4.6	0.7	9.6	2.4	0.3	33.8	42.8	0.0	5.4	100.0
		Numbers	32	475	78	1,001	253	32	3,525	4,459	0	564	10,419
Total	1,319	Percent	0.0	1.3	8.5	8.0	1.7	0.3	50.1	25.9	0.3	3.9	100.0
		Numbers	35	2,593	17,381	16,246	3,562	678	102,007	52,856	542	7,888	203,788

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.10. Age composition of the Red River late run sockeye escapement by statistical week, 1990.

Statistical Week	Sample Size		1.1	0.3	1.2	2.1	Age 1.3	2.2	1.4	2.3	3.2	Total
30	220	Percent	0.4	0.9	11.9	0.8	40.3	40.5	1.5	3.6	0.0	100.0
		Numbers	74	177	2,290	148	7,753	7,792	297	692	0	19,224
31	101	Percent	0.1	1.0	11.0	0.3	26.1	56.1	0.5	4.9	0.0	100.0
		Numbers	120	933	10,689	284	25,399	54,677	482	4,778	43	97,405
32	226	Percent	0.0	0.9	12.6	0.3	11.8	70.0	0.0	4.2	0.3	100.0
		Numbers	0	396	5,398	118	5,063	30,077	0	1,809	114	42,975
33	206	Percent	0.0	0.6	18.3	0.8	8.9	68.0	0.0	3.2	0.1	100.0
		Numbers	0	18	548	24	265	2,036	0	97	4	2,992
34	10	Percent	0.0	0.2	26.2	0.4	16.2	55.7	0.0	1.3	0.0	100.0
		Numbers	0	6	811	13	502	1,727	0	41	0	3,100
35	57	Percent	0.0	0.0	25.4	3.3	10.6	56.1	0.0	4.5	0.0	100.0
		Numbers	0	0	305	40	127	674	0	54	0	1,201
36	0	Percent	0.0	0.0	22.8	5.2	5.2	59.6	0.0	7.0	0.0	100.0
		Numbers	0	0	136	31	31	356	0	42	0	597
Total	820	Percent	0.1	0.9	12.0	0.4	23.4	58.1	0.5	4.5	0.1	100.0
		Numbers	194	1,530	20,177	658	39,140	97,339	779	7,513	161	167,494

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.11. Age composition of the Uganik Lake sockeye escapement by statistical week, 1990.

Statistical Week	Sample Size		Age								Total
			0.3	1.2	2.1	1.3	2.2	2.3	3.2	2.4	
26	0	Percent	0.0	10.8	0.5	26.3	23.5	38.0	0.0	0.9	100.0
		Numbers	0	8,296	361	20,199	18,035	29,217	0	721	76,830
27	213	Percent	0.0	10.8	0.4	26.5	23.5	37.8	0.0	0.9	100.0
		Numbers	0	2,192	91	5,374	4,767	7,676	0	188	20,290
28	146	Percent	0.0	10.9	0.2	28.6	23.7	35.8	0.0	0.8	100.0
		Numbers	0	1,927	44	5,044	4,182	6,326	0	143	17,666
29	64	Percent	0.0	12.1	0.0	35.1	22.6	29.9	0.0	0.4	100.0
		Numbers	0	747	0	2,164	1,393	1,844	0	27	6,174
30	197	Percent	0.0	12.7	0.0	41.8	18.2	27.3	0.0	0.0	100.0
		Numbers	0	508	0	1,668	727	1,090	0	0	3,993
31	35	Percent	0.0	6.2	0.0	33.1	33.6	27.1	0.0	0.0	100.0
		Numbers	0	277	0	1,472	1,496	1,206	0	0	4,452
32	42	Percent	0.0	20.9	0.3	18.9	34.0	25.8	0.0	0.0	99.8
		Numbers	0	137	2	124	223	169	0	0	656
33	26	Percent	0.0	23.3	2.5	9.2	41.1	23.9	0.0	0.0	100.0
		Numbers	0	84	9	33	148	86	0	0	360
34	75	Percent	0.0	22.0	2.9	19.1	40.2	14.8	1.0	0.0	100.0
		Numbers	0	46	6	40	84	31	2	0	209
35	16	Percent	0.0	26.5	1.3	17.9	37.7	15.9	0.7	0.0	100.0
		Numbers	0	40	2	27	57	24	1	0	151
36	7	Percent	9.5	38.9	0.0	4.8	22.2	15.9	9.5	0.0	100.8
		Numbers	12	49	0	6	28	20	12	0	126
37	0	Percent	14.2	42.7	0.0	0.0	14.2	14.2	14.2	0.0	99.6
		Numbers	38	114	0	0	38	38	38	0	267

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Statistical Week	Sample Size		Age									Total
			0.3	1.2	2.1	1.3	2.2	2.3	3.2	2.4	
38	0	Percent	14.3	43.0	0.0	0.0	14.3	14.3	14.3	0.0	100.3
		Numbers	51	153	0	0	51	51	51	0	356
Total	821	Percent	0.1	11.1	0.4	27.5	23.7	36.3	0.1	0.8	100.0
		Numbers	101	14,570	515	36,151	31,229	47,778	104	1,079	131,530

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.12. Age composition of the Upper Station early run sockeye escapement by statistical week, 1990.[a]

Statistical Week	Sample Size		0.2	1.1	0.3	1.2	Age 2.1	1.3	2.2	2.3	3.2	Total
22	0	Percent	0.0	0.0	0.0	20.0	0.0	0.0	40.0	20.0	0.0	100.0
		Numbers	0	0	0	1	0	0	2	1	0	5
23	584	Percent	0.0	0.0	0.0	26.1	0.1	6.0	46.7	21.0	0.0	100.0
		Numbers	0	0	0	2,598	13	599	4,646	2,083	0	9,939
24	218	Percent	0.0	0.0	0.0	31.8	0.1	5.5	48.6	14.1	0.0	100.0
		Numbers	1	0	0	2,516	5	433	3,849	1,114	0	7,918
25	216	Percent	1.7	0.0	0.1	30.5	0.8	3.8	57.7	5.4	0.0	100.0
		Numbers	414	0	29	7,468	207	922	14,126	1,314	0	24,480
26	214	Percent	1.9	0.0	0.6	37.4	0.9	3.4	52.5	3.3	0.0	100.0
		Numbers	163	2	48	3,259	80	295	4,577	287	0	8,711
27	216	Percent	2.1	0.5	0.4	47.7	0.7	1.6	45.9	1.1	0.0	100.0
		Numbers	41	10	8	929	13	32	894	21	0	1,948
28	222	Percent	2.6	0.4	0.1	45.7	0.4	0.5	49.8	0.5	0.0	100.0
		Numbers	25	4	1	444	4	5	484	5	0	971
29	209	Percent	4.2	0.0	3.2	23.0	0.0	1.4	64.7	1.8	1.8	100.0
		Numbers	92	0	69	502	1	30	1,415	40	39	2,187
Total	1,879	Percent	1.3	0.0	0.3	31.5	0.6	4.1	53.4	8.7	0.1	100.0
		Numbers	736	16	155	17,717	323	2,316	29,993	4,865	39	56,159

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.13. Age composition of the Upper Station late run sockeye escapement by statistical week, 1990.[a]

Statistical Week	Sample Size		0.2	1.1	0.3	1.2	2.1	1.3	2.2	2.3	3.2	3.3	Total
30	216	Percent	8.4	0.0	14.0	19.5	0.1	4.1	51.0	2.9	0.0	0.0	100.0
		Numbers	781	0	1,309	1,816	9	386	4,761	269	0	0	9,331
31	208	Percent	18.7	0.0	20.5	30.2	0.4	8.5	20.0	1.7	0.0	0.0	100.0
		Numbers	1,950	0	2,142	3,146	44	892	2,085	174	0	0	10,434
32	219	Percent	5.9	0.0	15.6	45.1	0.5	5.3	25.5	2.0	0.0	0.0	100.0
		Numbers	1,854	0	4,932	14,228	145	1,685	8,024	634	8	8	31,519
33	204	Percent	4.6	0.0	15.4	43.3	0.5	4.5	25.5	5.3	0.5	0.4	100.0
		Numbers	2,851	0	9,469	26,643	299	2,738	15,716	3,251	292	264	61,523
34	214	Percent	11.1	0.0	9.9	45.6	0.6	5.3	22.8	2.9	1.5	0.3	100.0
		Numbers	4,150	0	3,721	17,088	228	1,973	8,553	1,087	576	122	37,499
35	216	Percent	12.8	0.0	11.0	40.9	1.0	8.6	21.8	2.7	1.0	0.1	100.0
		Numbers	4,376	17	3,747	13,960	348	2,946	7,457	933	350	21	34,156
36	214	Percent	21.5	0.8	7.4	33.0	3.5	5.6	25.7	2.0	0.5	0.0	100.0
		Numbers	2,009	79	696	3,086	325	521	2,404	183	48	0	9,351
37	0	Percent	22.4	0.9	7.0	32.3	3.7	5.1	26.2	1.9	0.5	0.0	100.0
		Numbers	1,004	42	314	1,443	167	230	1,171	84	21	0	4,474
Total	1,491	Percent	9.6	0.1	13.3	41.1	0.8	5.7	25.3	3.3	0.7	0.2	100.0
		Numbers	18,975	138	26,330	81,410	1,565	11,371	50,171	6,615	1,295	415	198,287

[a] Percents are figured on escapement after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date.

Appendix A.14. Age composition of the Cape Alitak sockeye catch by statistical week, 1990.

Statistical Week	Sample Size		0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
22	0	Percent	0.0	0.0	0.0	52.6	0.0	0.0	5.3	10.5	0.0	26.3	0.0	0.0	0.0	94.7
		Numbers	0	0	0	10	0	0	1	2	0	5	0	0	0	19
23	0	Percent	0.6	0.0	1.8	53.0	0.0	0.0	6.2	11.7	0.0	26.6	0.0	0.0	0.0	100.0
		Numbers	52	0	173	5,000	0	0	588	1,107	0	2,509	0	0	0	9,430
24	545	Percent	0.6	0.1	1.6	56.4	0.2	0.0	5.5	11.1	0.0	23.8	0.0	0.0	0.8	100.0
		Numbers	454	46	1,305	46,405	161	0	4,542	9,169	0	19,575	0	23	667	82,347
25	0	Percent	0.6	0.3	0.5	70.2	1.0	0.0	2.5	8.6	0.0	12.0	0.0	0.1	4.2	100.0
		Numbers	67	35	66	8,488	122	0	303	1,040	0	1,447	0	17	506	12,090
26	543	Percent	0.6	0.4	0.3	75.9	1.0	0.0	2.1	6.5	0.0	8.6	0.0	0.1	4.5	100.0
		Numbers	1,198	812	528	152,172	2,014	0	4,298	12,941	0	17,162	0	275	9,028	200,428
27	536	Percent	0.6	0.6	0.5	78.9	0.3	0.0	4.7	2.8	0.0	9.2	0.0	0.0	2.3	100.0
		Numbers	1,490	1,372	1,189	188,213	612	0	11,310	6,792	65	22,019	0	18	5,471	238,551
28	562	Percent	0.2	0.7	1.2	70.0	0.4	0.0	8.7	6.4	0.1	10.7	0.0	0.0	1.7	100.0
		Numbers	178	656	1,181	68,768	370	0	8,512	6,277	124	10,516	0	0	1,637	98,220
29	537	Percent	0.7	0.5	1.2	69.5	0.5	0.0	6.5	9.0	0.0	11.1	0.0	0.0	1.0	100.0
		Numbers	459	296	759	42,757	323	0	3,979	5,536	5	6,813	0	0	610	61,536
30	611	Percent	2.1	0.3	4.6	55.3	0.2	0.0	11.5	16.7	0.0	8.6	0.0	0.2	0.4	100.0
		Numbers	1,725	272	3,772	45,276	176	0	9,419	13,656	0	7,048	0	155	352	81,850
31	595	Percent	3.3	0.2	7.7	43.8	0.0	0.0	17.6	22.0	0.0	5.0	0.1	0.2	0.0	100.0
		Numbers	6,720	436	15,565	88,089	0	0	35,345	44,271	0	9,960	137	436	0	200,958
32	520	Percent	3.2	0.1	8.3	39.8	0.0	0.0	19.2	23.9	0.1	4.9	0.4	0.0	0.0	100.0
		Numbers	2,928	71	7,529	36,025	0	0	17,396	21,644	63	4,444	357	8	0	90,467
33	536	Percent	2.9	0.1	8.2	41.5	0.4	0.2	12.1	28.3	0.1	5.8	0.3	0.1	0.2	100.0
		Numbers	949	17	2,711	13,803	119	80	4,006	9,400	17	1,915	108	40	80	33,244
34	606	Percent	3.3	0.0	7.9	41.4	0.5	0.3	10.4	30.4	0.0	5.1	0.2	0.2	0.3	100.0
		Numbers	1,217	0	2,922	15,280	183	122	3,835	11,201	0	1,887	61	61	122	36,890

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Statistical Week	Sample Size		Age 0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
35	0	Percent	3.3	0.0	7.9	41.4	0.5	0.3	10.4	30.4	0.0	5.1	0.2	0.2	0.3	100.0
		Numbers	1,179	0	2,830	14,801	177	118	3,715	10,850	0	1,828	59	59	118	35,734
36	0	Percent	3.3	0.0	7.9	41.4	0.5	0.3	10.4	30.4	0.0	5.1	0.2	0.2	0.3	100.0
		Numbers	438	0	1,051	5,498	66	44	1,380	4,030	0	679	22	22	44	13,273
37	0	Percent	3.3	0.0	7.9	41.4	0.5	0.3	10.4	30.4	0.0	5.1	0.2	0.2	0.3	100.0
		Numbers	106	0	253	1,325	16	11	332	971	0	164	5	5	11	3,198
38	0	Percent	3.3	0.0	7.9	41.4	0.5	0.4	10.3	30.4	0.0	5.2	0.1	0.1	0.4	100.0
		Numbers	26	0	63	328	4	3	82	241	0	41	1	1	3	793
Total	5,591	Percent	1.6	0.3	3.5	61.1	0.4	0.0	9.1	13.3	0.0	9.0	0.1	0.1	1.6	100.0
		Numbers	19,186	4,013	41,897	732,238	4,343	378	109,043	159,128	274	108,012	750	1,120	18,649	1,199,028

[a] Percents are figured on catch after rounding, not on samples. Sample sizes are for the indicated week. Age composition is calculated daily. Composition is based on two samples when the date falls between two sample dates. When the date falls on a sample date, or before the first sample or after the last sample, calculations are based on only one sample date. Catch figures represent statistical areas 257-10, 20, 41, 50, 60, and 70.

Appendix A.15.   Age composition of the Chignik sockeye catch by statistical week, 1990.

Statistical Week	Sample Size		Age													Total
			0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	
24	890	Percent	0.0	0.2	0.9	19.3	0.0	0.1	55.8	1.7	0.2	21.5	0.0	0.0	0.2	100.0
		Numbers	0	96	383	8,228	0	48	23,774	718	96	9,136	0	0	96	42,573
		SE	0	68	135	564	0	48	709	184	68	586	0	0	68	
25	1,775	Percent	0.0	0.3	0.2	35.1	0.0	0.1	43.3	3.5	0.5	16.8	0.1	0.1	0.1	100.0
		Numbers	0	436	218	45,262	0	145	55,797	4,577	581	21,650	73	145	73	128,958
		SE	0	178	126	1,461	0	103	1,517	566	205	1,144	73	103	73	
26	956	Percent	0.1	0.4	0.1	48.3	0.0	0.1	36.7	6.3	0.0	8.0	0.0	0.0	0.0	100.0
		Numbers	237	948	237	109,461	0	237	83,162	14,216	0	18,007	0	0	0	226,503
		SE	237	473	237	3,663	0	237	3,533	1,778	0	1,983	0	0	0	
27	1,036	Percent	0.1	0.0	0.5	39.5	0.0	0.0	23.9	7.9	0.3	27.7	0.0	0.1	0.0	100.0
		Numbers	215	0	1,074	87,870	0	0	53,281	17,617	645	61,660	0	215	0	222,576
		SE	215	0	479	3,382	0	0	2,952	1,868	372	3,096	0	215	0	
28	1,089	Percent	0.1	0.1	0.2	19.3	0.0	0.0	18.4	8.7	0.1	52.3	0.3	0.6	0.0	100.0
		Numbers	187	187	374	39,242	0	0	37,373	17,752	187	106,514	561	1,121	0	203,498
		SE	187	187	264	2,434	0	0	2,389	1,741	187	3,081	323	457	0	
29	503	Percent	0.2	0.0	1.8	8.3	0.0	0.2	10.9	4.6	0.0	73.2	0.0	0.8	0.0	100.0
		Numbers	714	0	6,429	30,001	0	714	39,287	16,429	0	262,864	0	2,857	0	359,295
		SE	714	0	2,126	4,436	0	714	5,004	3,350	0	7,106	0	1,424	0	
30	467	Percent	0.9	0.0	0.4	2.8	0.0	0.0	4.5	10.7	0.4	79.4	0.4	0.4	0.0	100.0
		Numbers	3,222	0	1,611	10,472	0	0	16,917	40,278	1,611	298,866	1,611	1,611	0	376,200
		SE	1,606	0	1,138	2,867	0	0	3,611	5,388	1,138	7,043	1,138	1,138	0	
31	566	Percent	0.4	0.0	1.8	1.6	0.0	0.0	3.4	8.7	0.2	82.9	0.0	1.2	0.0	100.0
		Numbers	944	0	4,720	4,248	0	0	8,967	23,126	472	221,352	0	3,304	0	267,133
		SE	667	0	1,481	1,406	0	0	2,024	3,160	472	4,235	0	1,242	0	
32	513	Percent	0.6	0.0	0.0	3.9	0.0	0.0	6.4	9.6	0.0	79.1	0.0	0.4	0.0	100.0
		Numbers	963	0	0	6,422	0	0	10,596	15,733	0	130,361	0	642	0	164,717
		SE	555	0	0	1,409	0	0	1,786	2,140	0	2,958	0	454	0	
33	346	Percent	0.0	0.0	0.6	2.0	0.0	0.0	2.3	5.2	0.0	89.6	0.0	0.3	0.0	100.0
		Numbers	0	0	778	2,724	0	0	3,113	7,005	0	120,644	0	389	0	134,654
		SE	0	0	550	1,021	0	0	1,090	1,610	0	2,213	0	389	0	

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Statistical Week	Sample Size		Age														Total
			0.2	1.1	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	
34	481	Percent	0.2	0.0	0.4	0.4	0.2	0.0	5.2	4.6	0.0	89.0	0.0	0.0	0.0	100.0
		Numbers	251	0	503	503	251	0	6,283	5,529	0	107,560	0	0	0	120,879
		SE	251	0	355	355	251	0	1,225	1,153	0	1,728	0	0	0	
35	458	Percent	0.0	0.0	0.0	1.3	0.0	0.0	2.8	9.0	0.0	86.0	0.0	0.9	0.0	100.0
		Numbers	0	0	0	921	0	0	1,995	6,292	0	60,464	0	614	0	70,285
		SE	0	0	0	374	0	0	546	939	0	1,140	0	306	0	
36-37	343	Percent	0.0	0.0	0.0	1.2	0.0	0.0	3.2	14.6	0.0	79.3	0.0	1.7	0.0	100.0
		Numbers	0	0	0	1,092	0	0	3,003	13,649	0	74,250	0	1,638	0	93,631
		SE	0	0	0	544	0	0	892	1,787	0	2,051	0	664	0	
Total	9,423	Percent	0.3	0.1	0.7	14.4	0.0	0.0	14.2	7.6	0.1	61.9	0.1	0.5	0.0	100.0
		Numbers	6,733	1,667	16,327	346,446	251	1,144	343,548	182,921	3,592	1,493,328	2,245	12,536	169	2,410,902
		SE	2,011	543	2,971	8,167	251	761	8,880	8,535	1,318	12,839	1,185	2,454	99	

Appendix A.16. Age and sex composition of sockeye salmon harvested in the Central District drift fishery, 1990.

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Sample Period 1: 25 June													
Males		18	520	18		1,544	556	108	538				3,302
Percent		0.30	8.78	0.30		26.07	9.39	1.82	9.08				55.76
Std. Error		0.08	0.18	0.30		0.08	0.17	0.17	0.06				
Sample Size		1	29	1		86	31	6	30				184
Females		18	162			1,525	197	36	682				2,620
Percent		0.30	2.74			25.75	3.33	0.61	11.52				44.24
Std. Error		0.08	0.02			0.07	0.02	0.02	0.09				
Sample Size		1	9			85	11	2	38				146
Both Sexes		36	682	18		3,069	753	144	1,220				5,922
Percent		0.61	11.52	0.30		51.82	12.72	2.43	20.60				100.00
Std. Error		0.15	0.19	0.30		0.15	0.19	0.19	0.15				
Sample Size		2	38	1		171	42	8	68				330
Sample Period 2: 29 June													
Males			833			5,431	603		1,867		57		8,791
Percent			5.32			34.69	3.85		11.92		0.36		56.14
Std. Error			0.09			0.05	0.14		0.05		0.05		
Sample Size			29			189	21		65		2		306
Females			345			4,598	86		1,781		57		6,867
Percent			2.20			29.37	0.55		11.37		0.36		43.86
Std. Error			0.02			0.04	0.00		0.04		0.05		
Sample Size			12			160	3		62		2		239
Both Sexes			1,178			10,029	689		3,648		114		15,658
Percent			7.52			64.05	4.40		23.30		0.73		100.00
Std. Error			0.11			0.09	0.14		0.09		0.09		
Sample Size			41			349	24		127		4		545

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	0.2	0.3	1.2	2.1	0.4	Age 1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Sample Period 3: 2 July													
Males			1,000			7,097	650		3,349				12,096
Percent			3.66			26.00	2.38		12.27				44.32
Std. Error			0.05			0.04	0.03		0.03				
Sample Size			20			142	13		67				242
Females		50	850			8,846	850	100	4,499				15,195
Percent		0.18	3.11			32.41	3.11	0.37	16.49				55.68
Std. Error		0.18	0.04			0.06	0.06	0.18	0.06				
Sample Size		1	17			177	17	2	90				304
Both Sexes		50	1,850			15,943	1,500	100	7,848				27,291
Percent		0.18	6.78			58.42	5.50	0.37	28.76				100.00
Std. Error		0.18	0.09			0.09	0.09	0.18	0.09				
Sample Size		1	37			319	30	2	157				546
Sample Period 4: 6 July													
Males			5,246			25,034	2,548	450	5,246				38,524
Percent			6.47			30.87	3.14	0.55	6.47				47.50
Std. Error			0.09			0.04	0.06	0.05	0.03				
Sample Size			35			167	17	3	35				257
Females		150	2,099			30,728	1,949	450	7,195				42,571
Percent		0.18	2.59			37.89	2.40	0.55	8.87				52.50
Std. Error		0.18	0.02			0.06	0.03	0.05	0.06				
Sample Size		1	14			205	13	3	48				284
Both Sexes		150	7,345			55,762	4,497	900	12,441				81,095
Percent		0.18	9.06			68.76	5.55	1.11	15.34				100.00
Std. Error		0.18	0.11			0.09	0.09	0.09	0.09				
Sample Size		1	49			372	30	6	83				541
Sample Period 5: 9 July													
Males	318	635	11,115			44,142	7,939	635	15,243				80,027
Percent	0.19	0.38	6.64			26.38	4.74	0.38	9.11				47.82
Std. Error	0.19	0.03	0.09			0.04	0.08	0.05	0.04				
Sample Size	1	2	35			139	25	2	48				252

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	0.2	0.3	1.2	2.1	0.4	Age 1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Females		953	5,081			58,115	4,446	635	18,101				87,331
Percent		0.57	3.04			34.72	2.66	0.38	10.82				52.18
Std. Error		0.07	0.02			0.06	0.02	0.05	0.06				
Sample Size		3	16			183	14	2	57				275
Both Sexes	318	1,588	16,196			102,257	12,385	1,270	33,344				167,358
Percent	0.19	0.95	9.68			61.10	7.40	0.76	19.92				100.00
Std. Error	0.19	0.10	0.11			0.10	0.10	0.09	0.10				
Sample Size	1	5	51			322	39	4	105				527

Sample Period 6: 16 July

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Males			46,577	1,059		146,084	23,289	2,117	53,987		1,059		274,172
Percent			7.97	0.18		25.00	3.99	0.36	9.24		0.18		46.92
Std. Error			0.11	0.18		0.03	0.06	0.08	0.04		0.18		
Sample Size			44	1		138	22	2	51		1		259
Females		7,410	13,762			207,480	17,996	1,059	62,456				310,163
Percent		1.27	2.36			35.51	3.08	0.18	10.69				53.08
Std. Error		0.18	0.01			0.06	0.03	0.02	0.05				
Sample Size		7	13			196	17	1	59				293
Both Sexes		7,410	60,339	1,059		353,564	41,285	3,176	116,443		1,059		584,335
Percent		1.27	10.33	0.18		60.51	7.07	0.54	19.93		0.18		100.00
Std. Error		0.18	0.12	0.18		0.09	0.09	0.10	0.09		0.18		
Sample Size		7	57	1		334	39	3	110		1		552

Sample Period 7: 18 July

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Males		65	3,143			6,548	3,732		4,452				17,940
Percent		0.19	9.14			19.05	10.86		12.95				52.19
Std. Error		0.05	0.17			0.03	0.12		0.04				
Sample Size		1	48			100	57		68				274
Females		65	196			10,151	982		4,976		65		16,435
Percent		0.19	0.57			29.53	2.86		14.48		0.19		47.81
Std. Error		0.05	0.00			0.07	0.01		0.05		0.19		
Sample Size		1	3			155	15		76		1		251

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	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Both Sexes		130	3,339			16,699	4,714		9,428		65		34,375
Percent		0.38	9.71			48.58	13.71		27.43		0.19		100.00
Std. Error		0.10	0.17			0.10	0.13		0.10		0.19		
Sample Size		2	51			255	72		144		1		525
Sample Period 8: 20 - 21 July													
Males	2,369	9,478	37,910			143,350	26,063		73,451				292,621
Percent	0.38	1.51	6.05			22.87	4.16		11.72				46.69
Std. Error	0.08	0.04	0.07			0.04	0.09		0.04				
Sample Size	2	8	32			121	22		62				247
Females	1,185	11,847	23,694			188,367	11,847	1,185	93,591	1,185	1,185		334,086
Percent	0.19	1.89	3.78			30.06	1.89	0.19	14.93	0.19	0.19		53.31
Std. Error	0.02	0.06	0.03			0.06	0.02	0.19	0.06	0.19	0.19		
Sample Size	1	10	20			159	10	1	79	1	1		282
Both Sexes	3,554	21,325	61,604			331,717	37,910	1,185	167,042	1,185	1,185		626,707
Percent	0.57	3.40	9.83			52.93	6.05	0.19	26.65	0.19	0.19		100.00
Std. Error	0.11	0.10	0.10			0.10	0.11	0.19	0.10	0.19	0.19		
Sample Size	3	18	52			280	32	1	141	1	1		529
Sample Period 9: 22 - 23 July													
Males			7,331			38,122	6,964	367	35,189		733		88,706
Percent			3.55			18.47	3.37	0.18	17.05		0.36		42.98
Std. Error			0.10			0.03	0.04	0.04	0.03		0.18		
Sample Size			20			104	19	1	96		2		242
Females		367	2,566			61,579	7,698	367	45,086				117,663
Percent		0.18	1.24			29.84	3.73	0.18	21.85				57.02
Std. Error		0.18	0.01			0.07	0.05	0.04	0.06				
Sample Size		1	7			168	21	1	123				321
Both Sexes		367	9,897			99,701	14,662	734	80,275		733		206,369
Percent		0.18	4.80			48.31	7.10	0.36	38.90		0.36		100.00
Std. Error		0.18	0.11			0.09	0.09	0.09	0.09		0.18		
Sample Size		1	27			272	40	2	219		2		563

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	0.2	0.3	1.2	2.1	0.4	Age 1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Sample Period 10: 25 - 26 July													
Males			1,523			9,792	4,134		10,446	326	218	326	26,765
Percent			2.71			17.44	7.36		18.61	0.58	0.39	0.58	47.67
Std. Error			0.07			0.04	0.09		0.04	0.04	0.05	0.05	
Sample Size			14			90	38		96	3	2	3	246
Females			979			12,186	2,067		13,165	435	218	326	29,376
Percent			1.74			21.71	3.68		23.45	0.77	0.39	0.58	52.33
Std. Error			0.03			0.06	0.02		0.06	0.06	0.05	0.05	
Sample Size			9			112	19		121	4	2	3	270
Both Sexes			2,502			21,978	6,201		23,611	761	436	652	56,141
Percent			4.46			39.15	11.05		42.06	1.36	0.78	1.16	100.00
Std. Error			0.10			0.10	0.11		0.10	0.10	0.10	0.10	
Sample Size			23			202	57		217	7	4	6	516
Sample Period 11: 27 July													
Males	901	1,802	10,814			40,554	4,956	901	28,387	451	451		89,217
Percent	0.38	0.76	4.59			17.21	2.10	0.38	12.05	0.19	0.19		37.86
Std. Error	0.19	0.05	0.07			0.02	0.02	0.08	0.03	0.19	0.02		
Sample Size	2	4	24			90	11	2	63	1	1		198
Females		1,802	6,759			77,952	9,913	451	48,213		901	451	146,442
Percent		0.76	2.87			33.08	4.21	0.19	20.46		0.38	0.19	62.14
Std. Error		0.05	0.03			0.08	0.08	0.02	0.08		0.08	0.19	
Sample Size		4	15			173	22	1	107		2	1	325
Both Sexes	901	3,604	17,573			118,506	14,869	1,352	76,600	451	1,352	451	235,659
Percent	0.38	1.53	7.46			50.29	6.31	0.57	32.50	0.19	0.57	0.19	100.00
Std. Error	0.19	0.10	0.10			0.10	0.11	0.11	0.10	0.19	0.11	0.19	
Sample Size	2	8	39			263	33	3	170	1	3	1	523
Sample Period 12: 29 July													
Males		211	2,000			10,528	737		7,580				21,056
Percent		0.38	3.65			19.19	1.34		13.82				38.39
Std. Error		0.01	0.05			0.03	0.02		0.03				
Sample Size		2	19			100	7		72				200

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	0.2	0.3	1.2	2.1	0.4	Age 1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Females		632	2,000			18,002	1,895		11,265				33,794
Percent		1.15	3.65			32.82	3.45		20.54				61.61
Std. Error		0.11	0.05			0.08	0.10		0.07				
Sample Size		6	19			171	18		107				321
Both Sexes		843	4,000			28,530	2,632		18,845				54,850
Percent		1.54	7.29			52.01	4.80		34.36				100.00
Std. Error		0.12	0.10			0.10	0.11		0.10				
Sample Size		8	38			271	25		179				521

Sample Period 13: 30 July

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Males		532	3,725			33,792	5,056	266	15,699	266			59,336
Percent		0.38	2.69			24.42	3.65	0.19	11.35	0.19			42.88
Std. Error		0.05	0.02			0.04	0.04	0.02	0.03	0.19			
Sample Size		2	14			127	19	1	59	1			223
Females		532	7,450			40,712	6,120	532	23,681				79,027
Percent		0.38	5.38			29.42	4.42	0.38	17.12				57.12
Std. Error		0.05	0.09			0.06	0.06	0.09	0.07				
Sample Size		2	28			153	23	2	89				297
Both Sexes		1,064	11,175			74,504	11,176	798	39,380	266			138,363
Percent		0.77	8.08			53.85	8.08	0.58	28.46	0.19			100.00
Std. Error		0.10	0.11			0.10	0.10	0.11	0.10	0.19			
Sample Size		4	42			280	42	3	148	1			520

Sample Period 14: 31 July - 7 September

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Males		140	3,628			13,954	2,372	140	8,093				28,327
Percent		0.20	5.07			19.49	3.31	0.20	11.31				39.57
Std. Error		0.01	0.05			0.03	0.03	0.01	0.02				
Sample Size		1	26			100	17	1	58				203
Females		419	3,768			20,511	3,488	419	14,512		140		43,257
Percent		0.59	5.26			28.65	4.87	0.59	20.27		0.20		60.43
Std. Error		0.11	0.05			0.07	0.07	0.11	0.08		0.19		
Sample Size		3	27			147	25	3	104		1		310

-Continued-

	0.2	0.3	1.2	2.1	0.4	1.3	2.2	1.4	2.3	3.2	2.4	3.3	Total
Both Sexes		559	7,396			34,465	5,860	559	22,605		140		71,584
Percent		0.78	10.33			48.15	8.19	0.78	31.58		0.20		100.00
Std. Error		0.12	0.10			0.10	0.10	0.12	0.11		0.19		
Sample Size		4	53			247	42	4	162		1		513
All Periods Combined:													
Males	3,588	12,881	135,365	18	1,059	525,972	89,599	4,984	263,527	1,043	2,518	326	1,040,880
Percent	0.16	0.56	5.87	0.00	0.05	22.81	3.89	0.22	11.43	0.05	0.11	0.01	45.14
Std. Error		0.01	0.05			0.03	0.03	0.01	0.02				
Sample Size	5	21	389	1	1	1,693	319	18	870	5	8	3	3,333
Females	1,185	24,245	69,711			740,752	69,534	5,234	349,203	1,620	2,566	777	1,264,827
Percent	0.05	1.05	3.02			32.13	3.02	0.23	15.15	0.07	0.11	0.03	54.86
Std. Error		0.11	0.05			0.07	0.07	0.11	0.08		0.19		
Sample Size	1	40	209			2,244	228	18	1,160	5	9	4	3,918
Both Sexes	4,773	37,126	205,076	18	1,059	1,266,724	159,133	10,218	612,730	2,663	5,084	1,103	2,305,707
Percent	0.21	1.61	8.89	0.00	0.05	54.94	6.90	0.44	26.57	0.12	0.22	0.05	100.00
Std. Error		0.12	0.10			0.10	0.10	0.12	0.11		0.19		
Sample Size	6	61	598	1	1	3,937	547	36	2,030	10	17	7	7,251

Appendix A.17. Age composition of the Red River sockeye catch by statistical week, 1990.

Statistical Week	Sample Size		0.2	1.1	0.3	1.2	2.1	Age 1.3	2.2	1.4	2.3	3.2	3.3	Total
22-24	534	Percent	0.2	0.7	1.5	24.3	0.2	43.4	24.7	0.0	4.9	0.0	0.0	100.0
		Numbers	1,163	4,653	9,306	151,227	1,163	269,881	153,553	0	30,245	0	0	621,192
		SE	1,163	2,320	3,269	11,547	1,163	13,337	11,607	0	5,791	0	0	
25	507	Percent	0.0	0.2	1.8	37.7	0.0	26.2	26.0	0.0	6.7	0.4	1.0	100.0
		Numbers	0	403	3,623	76,888	0	53,540	53,137	0	13,687	805	2,013	204,096
		SE	0	403	1,198	4,397	0	3,991	3,982	0	2,269	569	897	
26	543	Percent	0.0	1.3	1.8	41.4	0.4	20.3	26.0	0.0	7.6	0.0	1.3	100.0
		Numbers	0	2,109	3,013	67,803	603	33,148	42,490	0	12,355	0	2,109	163,632
		SE	0	793	945	3,462	426	2,825	3,082	0	1,857	0	793	
27	546	Percent	0.0	1.1	0.5	52.7	0.2	19.6	16.5	0.2	9.0	0.0	0.2	100.0
		Numbers	0	1,874	937	89,931	312	33,412	28,103	312	15,301	0	312	170,494
		SE	0	761	540	3,646	312	2,899	2,710	312	2,087	0	312	
28	519	Percent	0.0	0.4	0.4	52.8	0.0	19.5	22.5	0.0	4.2	0.0	0.2	100.0
		Numbers	0	907	907	124,327	0	45,829	53,088	0	9,982	0	454	235,495
		SE	0	641	641	5,165	0	4,096	4,324	0	2,085	0	454	
29	530	Percent	0.4	0.4	0.8	28.5	0.0	18.1	44.3	0.0	7.5	0.0	0.0	100.0
		Numbers	186	186	372	14,030	0	8,919	21,834	0	3,716	0	0	49,243
		SE	131	131	185	966	0	825	1,064	0	566	0	0	
30	524	Percent	0.0	0.8	0.0	42.6	0.2	18.5	26.7	0.2	11.1	0.0	0.0	100.0
		Numbers	0	83	0	4,636	21	2,017	2,911	21	1,206	0	0	10,894
		SE	0	41	0	236	21	185	211	21	149	0	0	
31-34	509	Percent	2.7	0.0	5.7	27.7	0.8	8.2	36.3	0.0	7.1	10.8	0.6	100.0
		Numbers	606	0	1,256	6,105	173	1,818	8,010	0	1,559	2,381	130	22,037
		SE	160	0	227	438	86	269	470	0	251	304	75	
Total	4,212	Percent	0.1	0.7	1.3	36.2	0.2	30.4	24.6	0.0	6.0	0.2	0.3	100.0
		Numbers	1,955	10,215	19,414	534,947	2,272	448,564	363,126	333	88,051	3,186	5,018	1,477,083
		SE	1,182	2,680	3,715	14,346	1,281	15,092	13,693	313	7,158	645	1,320	